C-DOT OVP

HVP / ROI CARD USER MANUAL

(High Voltage Protection solution for C-DOT DSS)

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THIS C-DOT SYSTEM PRACTICE REFERS TO THE C-DOT OVER VOLTAGE PROTECTION SOLUTION (ABBREVIATED AS C-DOT OVP IN THE REST OF THIS PUBLICATION).

THE INFORMATION IN THIS SYSTEM PRACTICE IS FOR INFORMATION PURPOSES AND IS SUBJECT TO CHANGE WITHOUT NOTICE.

A COMMENT FORM HAS BEEN INCLUDED AT THE END OF THIS PUBLICATION FOR READER'S COMMENTS. IF THE FORM HAS BEEN USED, COMMENTS MAY BE ADDRESSED TO THE DIRECTOR (C&S), CENTRE FOR DEVELOPMENT OF TELEMATICS, C-DOT CAMPUS,MEHRAULI, NEW DELHI - 110 030

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Table of Contents

Chapter 1. Introduction 5

1.1. HVP Card 5

1.2. Over Voltage and Over Current Conditions 5

1.3. Need for HVP Card 5

Chapter 2. General Description of HVP Card 6

2.1. Function 6

2.2. General Overview 6

2.3. Primary Protection 7

2.4. Secondary Protection 7

2.5. Co-ordination of Primary and Secondary Protection by 20Ω PTC Thermistor 7

2.6. Protection Ground 8

Chapter 3. Site Preparation 9

Chapter 4. HVP Installation IN MBM/RSU/SBM 10

4.1. Estimation of items to be ordered in HVP Kit depending on the configuration of MBM / RBM /SBM 10

4.2. Part List for OVP for MBM/ RSU / SBM System 11

4.3. HVP Assembly Procedure for MBM / RSU / SBM 13

4.4 Figure : Fixing HVP Ground Bus Bar in ATU of BM/LM 15

4.5 Figure : Fixing BM Protection Bus Bar and HVP Card in BM/LM Cabinet 16

4.6 Figure : Ground Cable Routing in BM/LM Cabinet, Suite PDP in MBM/RBM/SBM 17

Chapter 5. Cable Diagrams for MBM/RBM/SBM 18

5.1 Figure : HVP Bus Bar Link Cable General Assembly 19

5.2 Figure : TU-BM Bus Bar PGND Cable General Assembly 20

5.3 Figure : BM-PDP PGND Cable General Assembly 21

5.4 Figure : PDP-Earth Collector Plate PGND Cable General Assembly 22

Chapter 6. HVP Installation in AN-RAX 23

6.1. Site Inspection, Requirements and Assembly Procedure 23

6.2. Checklist for AN-RAX 23

6.3. Partlist for OVP for AN-RAX System 27

6.4. Equipping ROI Card 28

6.5. Equipping HVP Card 28

6.6 Figure : Routing Diagram 30

6.7 Figure : Fixing of HVP Ground Bus Bar In ATU of AN-RAX 31

6.8 Figure : Fixing of HVP Card in ATU of AN-RAX 32
6.9 Figure : Routing and Termination of Ground Cables in AN-RAX 33
Chapter 7. Cable Diagrams for AN-RAX.... 34
7.1 Figure : HVP Bus Bar Link Cable 35
7.2 Figure : AN-RAX/RAX P-Ground Cable-II 36
7.3 Figure : RS 232 OPTO Isolator I/F Cable General Assembly 37
Chapter 8. Test Procedure for HVP Card.... 38
8.1. Testing HVP Card....38
8.2. Detailed Test Procedure 38
8.3 Figure : Circuit Schemetics for HVP Card 40
8.4 Figure : Connector Pin Assignment for HVP Card....41
8.5 Figure : Component Placement Chart for HVP Card....42
8.6 Component List for HVP Card 43
Chapter 9. Test Procedure for ROI Card.... 45
9.1. Functional Specification 45
9.2. General Description 45
9.3. Detailed Test Procedure 46
9.4. RS232 Port Testing....47
9.5. Test Setup....49
9.6. Figure : ROI Tester Cable (for Power Supply and Loop-Back) 50
9.7. Part List for ROI Tester Cable Assembly (for Power Supply & Loopback)....51
9.8. Circuit Description for ROI Card....52
9.9. Figure : Circuit Schematics for ROI Card 53
9.10. Connector Pin Assignment for ROI Card 54
9.11. Figure : Component Placement Chart for ROI Card (Component Side) 55
9.12. Figure : Component Placement Chart for ROI Card (Solder Side)....56
9.13. Component List for ROI Card 57

Chapter 1.

Introduction

1.1. HVP CARD

The High Voltage Protection (HVP) card provides primary and secondary protection integrated into a single PCB which interfaces line circuit card in C-DOT DSS. HVP card supports 8 subscribers which is plugged to LCC card Euro connector on the rear side of ATU motherboard. Subscriber cables from MDF are plugged to HVP card Euro connector.

1.2. OVER VOLTAGE AND OVER CURRENT CONDITIONS

Voltage surges due to lightning strikes.

Direct contact between power and telecommunication links.

Induction of voltage in telecom lines from power lines.

Earth potential rise due to power faults.

Transient voltage surges in mains voltage lines.

1.3. NEED FOR HVP CARD

Present primary protection employs IPMs in MDF. IPMs contain GD Tubes and fuses / PTC Thermistor. However, a lot of failures from lightning / power induction / contact was reported due to improper IPM maintenance in MDF. As MDF is handled regularly by various persons, it is possible that some lines may be left unprotected. This has lead to development of HVP card which addresses the MDF maintenance problem and has value addition compared to IPM alone in MDF as a means of protection. HVP offers both primary and fast acting secondary protection unlike IPMs which has only primary protection.

By providing HVP card, we can ensure that, protection device is in its place and not disturbed like IPMs in MDF. All these factors offer distinct advantage and definitely has value addition compared to having IPM protection alone in MDF.

Chapter 2.

General Description of HVP Card

2.1. FUNCTION

This chapter deals with the functional aspects of HVP card and components used in HVP card. This card protects eight subscriber ports. It is mounted on the rear side of ATU motherboard and is plugged in line card slot where MDF cables are plugged. Once HVP card is in place, subscriber cables from MDF are plugged to HVP card connector.

2.2. GENERAL OVERVIEW

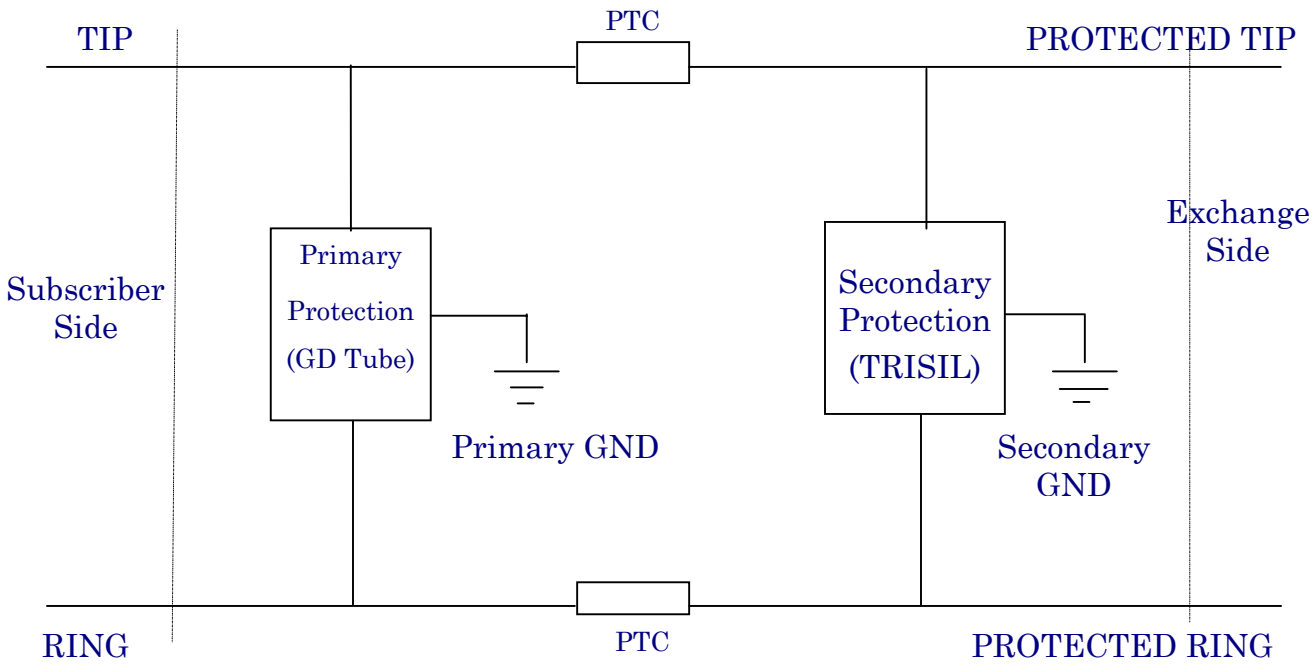
The various blocks in the card are:

1) Primary Protection

2) Secondary Protection

3) Co-ordination Element

4) Protection Ground



2.3. PRIMARY PROTECTION

Most of the stressful energy is absorbed at the primary protection level. Primary protection is provided by Gas Discharge Tube (GDT). For protecting two lines, i.e., TIP& Ring, three electrode GD Tubes are used. Two electrodes are connected to TIP and Ring of subscriber line and a ground electrode of GD Tube is connected to protection ground.

When an increasing voltage is present, spark over will occur when strength of charge exceeds ionization voltage of GD Tube and GD Tube starts conducting to ground, offering low resistance path. When GD Tube starts conducting, TIP and/or Ring of subline are connected to ground with very low resistance path, thereby diverting the electrical charge to ground. GD Tube has a very high current carrying capacity, but slower in response time compared to secondary protection element. When GD Tube discharges very heavy current beyond its rated capacity and subjected to thermal stress, a short circuiting mechanism built into GD Tube, shorts TIP or RING to ground permanently.

Typical DC spark over voltage (100V/s) is 180-300V and surge spark over voltage (1 KV/μs) is >900V for GD Tube. Failure mode is short circuit.

2.4. SECONDARY PROTECTION

Secondary protection is provided by a fast acting semi conductor device (i.e., TRISIL – Bidirectional Thyristor) which is three electrode device. As primary protection operates slowly compared to secondary protection, residual energy is passed on to secondary protection. Secondary protection diverts energy on TIP AND / OR Ring to ground.

When the voltage on TIP AND / OR Ring exceeds 220V, TRISIL operates by shorting TIP/Ring to ground.

Secondary protection is a precise and fast acting semi conductor device (TRISIL) and it is likely to be damaged by excessive currents, unless primary and secondary protection is co-ordinated properly.

Proper co-ordination between primary and secondary is achieved by using 20Ω PTC thermistor

2.5. CO-ORDINATION OF PRIMARY AND SECONDARY PROTECTION BY 20Ω PTC THERMISTOR

The resistance value of PTC Thermistor is decided by current handling capacity of TRISIL. Optimum value chosen for PTC Thermistor for HVP Card is 20Ω. PTC Thermistor is mainly intended to limit over current of long duration and normally will not respond to switching transients caused by lightning discharge.

When fault current of long duration flows through PTC Thermistor, temperature of the device rises, which in turn, decreases the conductivity and the device trips. Device surface temperature in tripped state is around 120°C. Once the temperature is lowered, PTC resumes conduction.

2.6. PROTECTION GROUND

Protection ground is connected to exchange earth and for the HVP solution to be effective, a standard earth of value below 0.5Ω is recommended.

Primary ground and secondary ground in HVP PCB are shorted and are given to ring terminal, which is taken out with a wire and connected to the Protection Bus Bar of the system. HVP Card is fixed on to the Bus Bars on the cable side of ATU motherboard using lock screw brackets, which are mounted on HVP PCB.

Chapter 3.

Site Preparation

- For HVP solution to be effective, proper earthing is very critical. The existing earth is to be measured and cables of proper dimensions recommended should be used. From earth pit to earth collector plate, 19/1.8mm^2 BTC wire should be used. Earth should be a standard exchange earth with a value of less than 0.5Ω.
- Power plant (float rectifier) AC input voltage should be routed through lightning arrestor unit to prevent surge voltages from the power plant.
- For AN-RAX sites, recommended ground cables of proper dimensions should be used as per the checklist provided.
- AC input power to Exchange Float Rectifier is given from a distribution transformer of local electricity supply company. An inspection may be done with Electricity Supply company authorities to know whether lightning arrestors are installed on HT input side of distribution transformer feeding power to Exchange Float Rectifier. If lightning arrestors are not installed, then co-ordinated effort may be done to ensure that they are installed by the local Electricity Company.

Chapter 4.

HVP Installation IN MBM/RSU/SBM

4.1. ESTIMATION OF ITEMS TO BE ORDERED IN HVP KIT DEPENDING ON THE CONFIGURATION OF MBM / RBM /SBM

The items to be ordered in HVP kit depends on the configuration of MBM/RSU/ SBM. HVP kits may be ordered depending on the number of BMs and LMs. If a BM is having only DTUs, then HVP Kit need not be ordered for that BM. However, if any ATU is available in any of the Trunk BMs, then BM is to be included in the ordering information.

The exact requirement of HVP kit can be assessed using the Partlist for OVP for MBM / RSU/SBM system as given in Section 4.2.

Here, RSU and RBM notations used are interchangeable when referring to a BM located at a remote site. The number of BMs, LMs, ATUs varies from site to site depending upon the equipped capacity of MBM/RSU/SBM. While working out ordering information for HVP, no. of BM & LM cabinets, ATUs in BM/LM cabinets in the site may be inspected and properly accounted.

4.2. PART LIST FOR OVP FOR MBM/ RSU / SBM SYSTEM

Item No.	Part No.	Description	Specification	Remarks	Size Code	Qty	Unit Code
1.	APC-HVPE44/T-SA1	HIGH VOLTAGE PROTECTION CARD				N x 16	Nos.
2.	ACB-RAXHBHB0-000	HVP BUS BAR LINK CABLE				N	Nos.
3.	ACB-MAXBBPBX-000	BM-PDP PGND CABLE ASSY. (FOR RSU)		$		03	Nos.
		BM-PDP PGND CABLE ASSY. (FOR MBM)		$		M x S	Nos.
4.	ACB-MAXPBEC0-000	PDP-EARTH COLLECTOR PLATE PGND CABLE ASSY.		#		01	No.
5.	ACB-MAXTUBBX-000	TU-BM BUS BAR PGND CABLE ASSY.				N	Nos.
6.	MAH-VPUNZ100-201	BPB BUS BRKT. ASSY.				M	Nos.
7.	MAH-VPUNZ002-201	SPB BUS BRKT. ASSY.				S	Nos.
8.	MAH-VPUNZ040-301	BUS BAR ASSY (HVP)				N x 2	Nos.
9.	MPH-VPUNZ020-201	BUS BAR ISOLATOR (HVP)				N x 2	Nos.
10.	MPH-VPUNZ100-401	MOTHER BOARD SCREW (HVP)				N x 4	Nos.
11.	MPH-VPUNZ090-401	BUS BAR BUSH (HVP)				N x 4	Nos.
12.	MCN-HESSM002-401	NUT HEX SST - M2.5				N x 4	Nos.
13.	MCW-CHSSZ002-401	WASHER PLAIN SST – M2.5				N x 4	Nos.
14.	MCS-CHSSM089-401	SCR CH HD SST – M6X8				N x 3	Nos.
15.	MCW-CHSSZ007-401	WASHER PLAIN SST – M6				N x 3	Nos.
16.	MCA-CBLTZ000-401	CABLE TIE 75MM (NON RELEASABLE)				M x 20	Nos.
17.	MCC-BPCSZ004-301	EXTENDED LATCH				N x 32	Nos.
18.	MCC-BPCSZ002-301	2X32 LATCH FRAME				N x 16	Nos.

							TITLE	
							PART LIST FOR OVP FOR MBM/RSU SYSTEM	
							DOC CODE	NUMBER
							PL	AUN-OVPMBM00-000
								SHEET NO: 1 OF 2
								ISSUE : 01
							CENTRE FOR DEVELOPMENT OF TELEMATICS, BANGALORE, INDIA	
ECO. NO.	DATE	ENGR	APPD	PART NO.	ITEM	QTY		
				NEXT ASSY				

PART LIST FOR OVP FOR MBM/ RSU / SBM SYSTEM (CONTD.)

Item No.	Part No.	Description	Specification	Remarks	Size Code	Qty	Unit Code
19.	MCS-HESSM024-401	SCR HEX SST–M5 X 12				M x 2	Nos.
20.	MCW-PLSSZ005-401	WASHER SST-M5				M x 2	Nos.
21.	MCN-HESSM006-401	NUT HEX SST – M5				M x 2	Nos.

ECO. NO.	DATE	ENGR	APPD	PART NO.	ITEM	QTY
				NEXT ASSY		

TITLE

PART LIST FOR OVP FOR MBM/RSU SYSTEM

DOC CODE	NUMBER	SHEET NO:
PL	AUN-OVPMBM00-000	2 OF 2
		ISSUE : 02

CENTRE FOR DEVELOPMENT OF TELEMATICS, BANGALORE, INDIA

Note : N = No. of Total TU frames/motherboards (APC-TUB003/T-M03/M04) of all cabinets.

M = No. of cabinets

S = No. of suites (1 - 5)

= See drawing

$ = For RSU (X = 0 to 2), For MBM (X= 0 to 7)

4.3. HVP ASSEMBLY PROCEDURE FOR MBM / RSU / SBM

For assembly, along with the following procedure, refer the figures 4.4, 4.5 & 4.6.

1. Power-off individual cabinets where HVP card is to be equipped, after modifying status of units properly using commands.

2. Jacking in HVP is obstructed by cable tray in old BM / LM cabinets. In order to overcome this problem, the following steps are to be followed: In old type of cabinets, the cable tray on which subscriber cables from MDF are routed, is held by 4 screws. Remove all 4 screws and cut the cable ties to make provision for pulling out cable tray slightly outwards (towards the rear door). Use 2 screws only and fix cable tray using inside holes of cable tray. 2 outer holes of cable tray are to be left unused.

3. Fix bus bar bracket assembly on the rear side of the cabinet at position where 3rd and 4th frames meet (after 6th power filter from top). The fixing procedure is different for old and new types of cabinets. The details are as given below: Different holes are provided on each end of BPB bracket bus bar assembly. 2 holes are used for fixing bracket to old type of cabinets and 2 holes are used for fixing bracket to new type of cabinet as shown in Figure 4.5. For old type of cabinet, use existing nut and screw in cabinet in position for fixing the bracket to the cabinet. For new types of cabinets, drill marks should be done 15mm from the front edge of the upright in between 3rd and 4th TU (after 6th power filter from top). Then drilling should be done on the drill mark using 6mm drill bit. For new type of cabinets, 2 sets of screws M5x12 - MCS-HESSM024-401, M5 washer - MCW-PLSSZ005-401, M5 nut - MCN-HESSM006-401 are to be used for fixing the bracket to the cabinet.

4. Jack out and remove all the cards from slots 3 to 10 and 17 to 24 of the system of all analog TU frames where HVP cards are to be equipped.

5. Unplug the existing subscriber cables coming from MDF on rear side of TU and remove the extended latches from line card slots at the rear side of the system (cable side).

6. Replace the existing 4-module latch frame (MCC-BPCSZ001-301) at the shroud on the connector A with 2 by 32 latch frame (MCC-BPCSZ002-301).

7. Remove the fixing screws (2 nos.) and the polarizing bar (MPR-AXCBZ090-301) one by one while holding the hex nut on the other side (card side) of motherboard.

8. Fix the HVP bus bar assembly (MAH-VPUNZ040-301) on the rear side (cable side), using the new screws MPH-VPUNZ100-401 and the bus bar bushes along with the polarization bar as shown in figure 4.4. Ensure polarizing bar is aligned properly with the HVP bus bar. Similarly, fix the second busbar on the motherboard.

9. Connect two HVP bus bars with the HVP bus bar link cable shown in Figure 5.1 (ACB-RAXHBHB0-000) at the neighbouring ends with M6x8 screws (MCS-CHSSM089-401) and M6 washer (MCW-CHSSZ007-401).

10. Now place the HVP card (with casing) on connector A of line card slot and then tighten the HVP card lock screw till the card is inserted fully. Repeat this for all line card slots. All the line card slots should be equipped with HVP cards irrespective of the fact that line cards are equipped in that slot or not. This is to take care of inadvertent equipping of line cards in future without HVP cards.

11. Terminate 2.5SQ.MM cable (P_GND cable) coming from the HVP card, on the respective faston tab provided on the HVP bus bar fixed.

12. Fix the latch frames on the HVP cards.

13. Plug the subscriber cables on the HVP cards.

14. Follow points 4 to 13 for each TU.

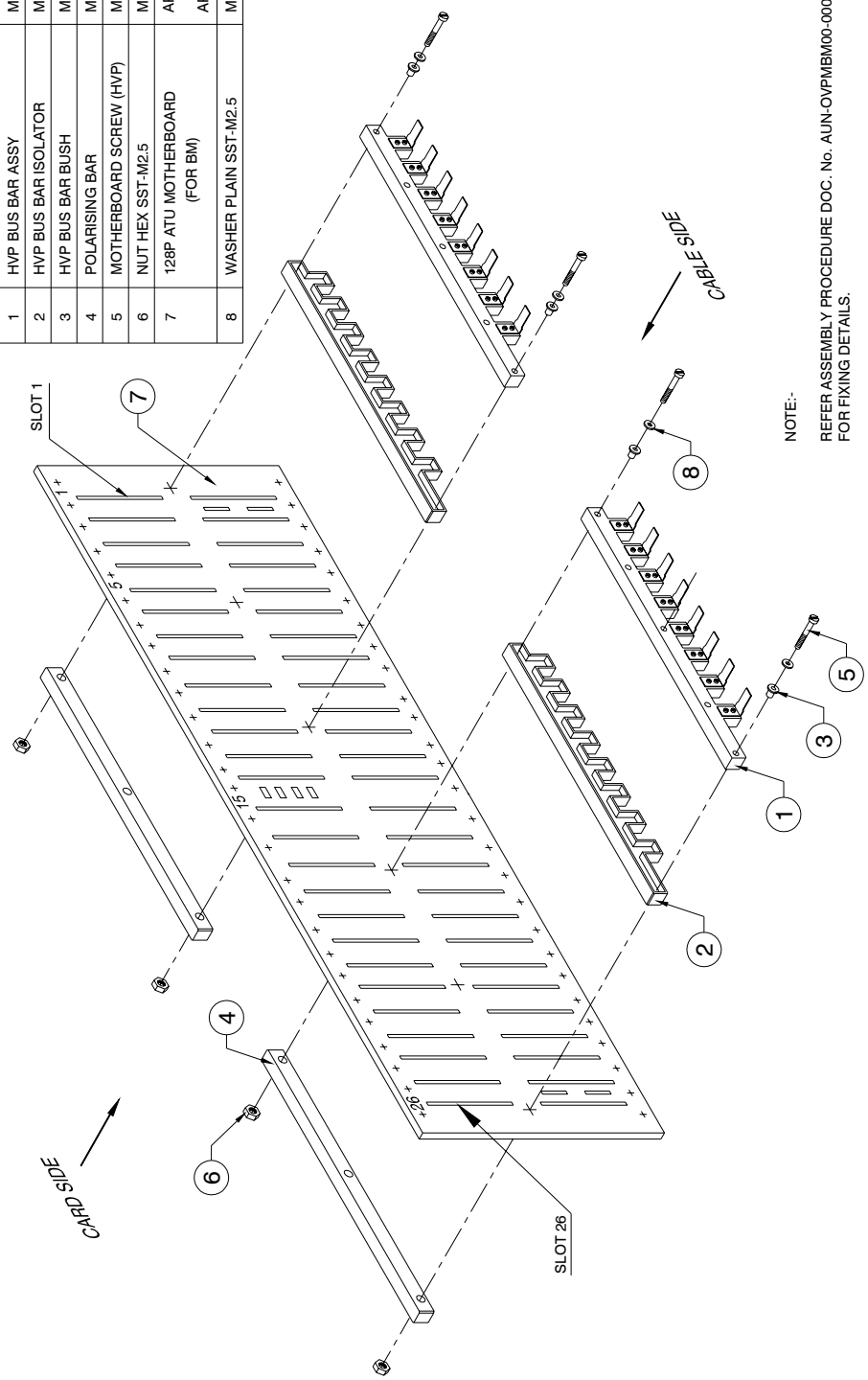
15. Connect the TU-BM busbar PGND cable shown in Figure 5.2 (25 sq.mm. black cable- ACB-MAXTUBBX-000) from the HVP bus bar on the ATU motherboard to the BPB bracket bus bar (fixed in the cabinet in between 3rd and 4th TU) at the location marked for the respective TU.

16. Terminate one end of the cable shown in Figure 5.3 (50 sq.mm black cable – ACB-MAXBBPBX-000) on the BPB bracket bus bar and route it to PDP through suite trough and terminate the other end on SPB bracket bus bar in PDP at the respective cabinet position marked. Refer Figure 4.6.

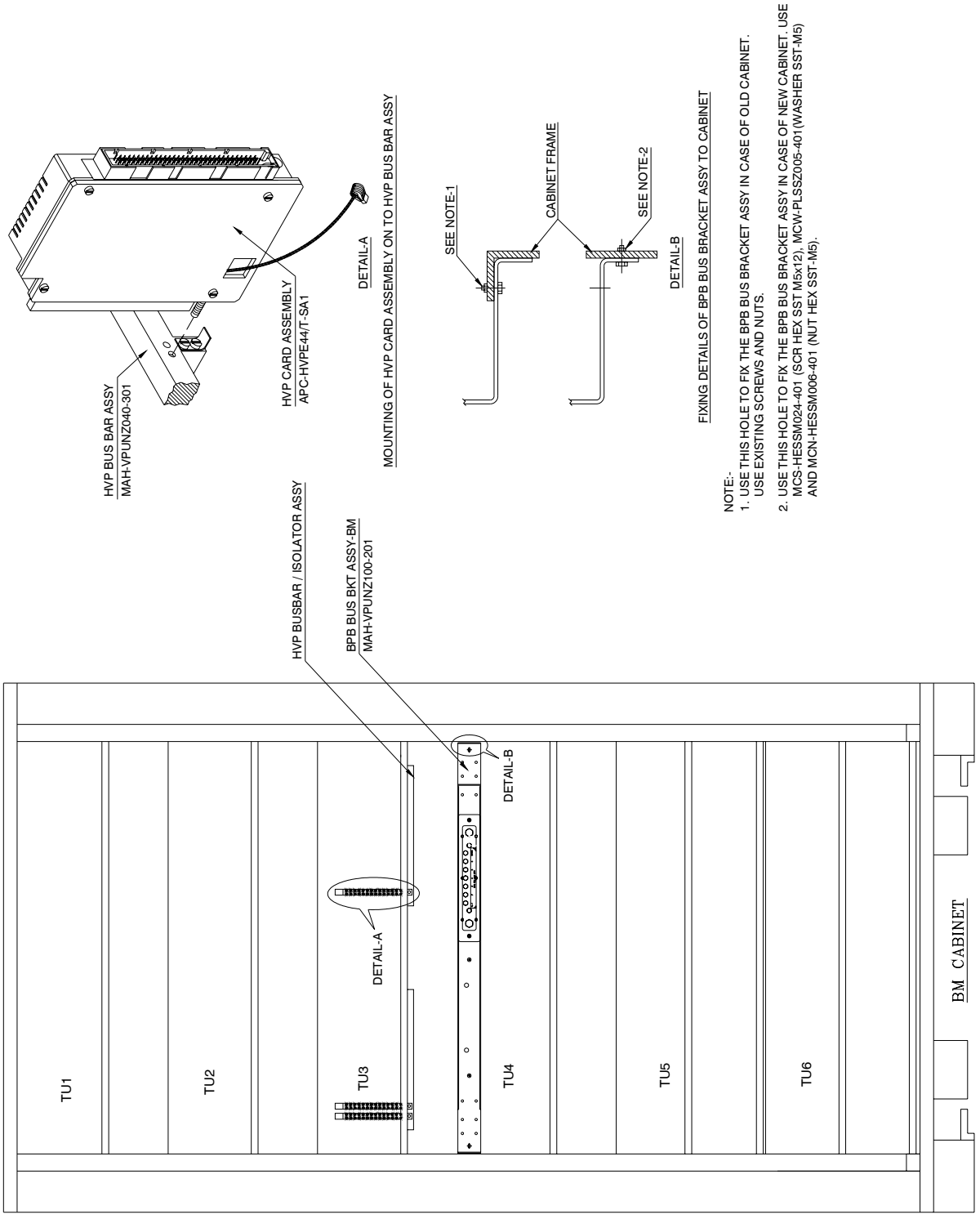
17. Use cable shown in Figure 5.4 (120 sq.mm black cable - ACB-MAXPBEC0-000) to extend suite PDP earth (P-Ground) to the earth collector plate. In case of MBM exchange, all the suite PDP (P-Ground) plates have to be shorted in a daisy-chain fashion and the last suite PDP can be extended to earth pit. Refer Figure 4.6. If the length of the cable is more than 25 metres, it is suggested to use 2 nos. of 120 sq.mm black cable to be routed in parallel to earth collector plate.

4.4 FIGURE : FIXING HVP GROUND BUS BAR IN ATU OF BM/LM

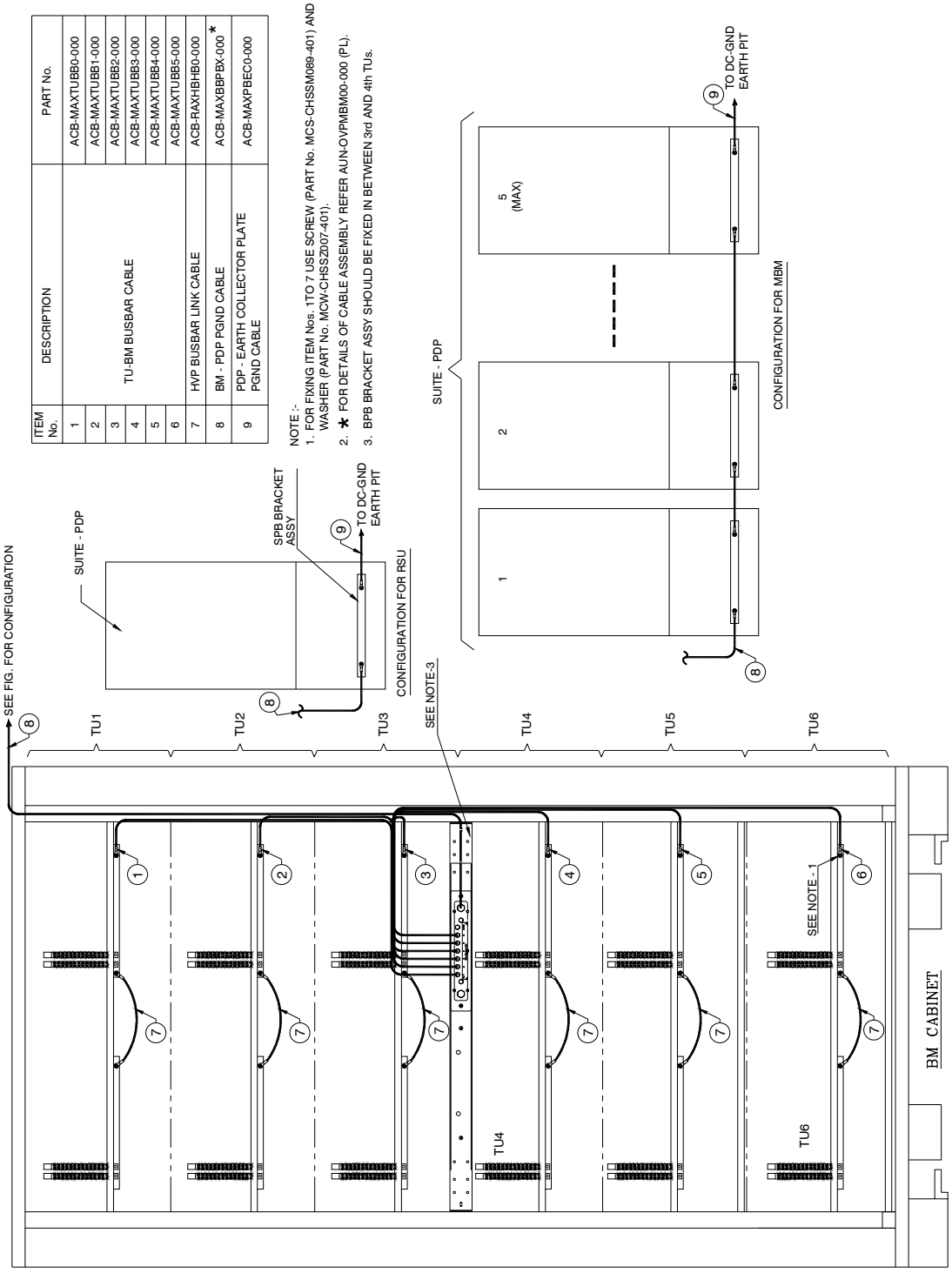
ITEM No.	DESCRIPTION	PART No.
1	HVP BUS BAR ASSY	MAH-VPUNZ040-301
2	HVP BUS BAR ISOLATOR	MPH-VPUNZ020-201
3	HVP BUS BAR BUSH	MPH-VPUNZ090-401
4	POLARISING BAR	MPR-AXCBZ090-301
5	MOTHERBOARD SCREW (HVP)	MPH-VPUNZ100-401
6	NUT HEX SST-M2.5	MCN-HESSM002-401
7	128P ATU MOTHERBOARD (FOR BM)	APC-TUB003/T-M03 OR APC-TUB003/T-M04
8	WASHER PLAIN SST-M2.5	MCW-CHSSZ002-401



4.5 FIGURE : FIXING BM PROTECTION BUS BAR AND HVP CARD IN BM/LM CABINET


HVP BUS BAR ASSY
MAH-VPUNZ040-301
HVP CARD ASSEMBLY
APC-HVPE44/T-SA1
DETAIL-A
MOUNTING OF HVP CARD ASSEMBLY ON TO HVP BUS BAR ASSY
SEE NOTE-1
CABINET FRAME
SEE NOTE-2
DETAIL-B
FIXING DETAILS OF BPB BUS BRACKET ASSY TO CABINET
NOTE:-
1. USE THIS HOLE TO FIX THE BPB BUS BRACKET ASSY IN CASE OF OLD CABINET. USE EXISTING SCREWS AND NUTS.
2. USE THIS HOLE TO FIX THE BPB BUS BRACKET ASSY IN CASE OF NEW CABINET. USE MCS-HESSM024-401 (SCR HEX SST M5x12), MCW-PLSSZ005-401(WASHER SST-M5) AND MCN-HESSM006-401 (NUT HEX SST-M5).
HVP BUSBAR / ISOLATOR ASSY
BPB BUS BKT ASSY-BM
MAH-VPUNZ100-201
DETAIL-B
DETAIL-A
TU1
TU2
TU3
TU4
TU5
TU6
BM CABINET

4.6 FIGURE : GROUND CABLE ROUTING IN BM/LM CABINET, SUITE PDP IN MBM/RBM/SBM



Chapter 5.

Cable Diagrams for MBM/RBM/SBM

This chapter gives information on various ground cables used in C-DOT MBM / RBM / SBM during HVP installation.

The following figures may be referred for assembly instructions for ground cables used in MBM / RBM / SBM systems:

5.1	Figure	→	HVP busbar link cable (used for shorting two ground bars in ATU).
5.2	Figure	→	TU-BM busbar PGND cable (used for extending ground from BM protection busbar in BM/LM cabinet to ATU ground bar).
5.3	Figure	→	BM – PDP PGND cable (used for extending ground from PDP ground bar to BM protection bus bar).
5.4	Figure	→	PDP – Earth collector plate cable (used for extending ground from exchange earth collector plate to PDP ground bar).

5.1 FIGURE : HVP BUS BAR LINK CABLE GENERAL ASSEMBLY

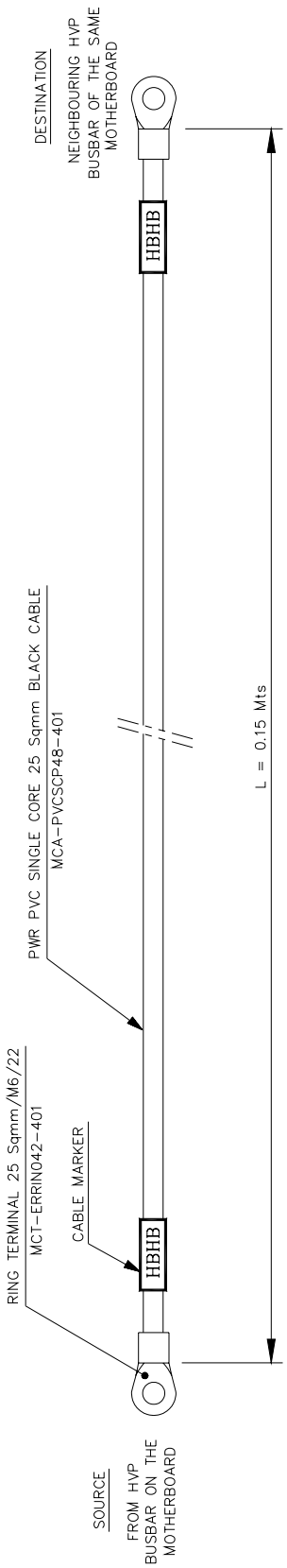


TABLE - 1

CDOT ASSY No.	ACB-RAXHBHB0-000
CABLE PART No.	ACB-RAXHBHB0-000
CABLE MARKER No.	HBHB
CABLE SPECIFICATION	PWR PVC SINGLE CORE 25 Sqmm BLACK
CABLE LENGTH	L = 0.15 Mtrs
SOURCE TERMINATION PART No.	MCT-ERRIN042-401
DESTINATION TERMINATION PART No.	
SOURCE	HVP BUSBAR ON THE MOTHERBOARD
DESTINATION	NEIGHBOURING HVP BUSBAR OF THE SAME MOTHERBOARD
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

5.2 FIGURE : TU-BM BUS BAR PGND CABLE GENERAL ASSEMBLY

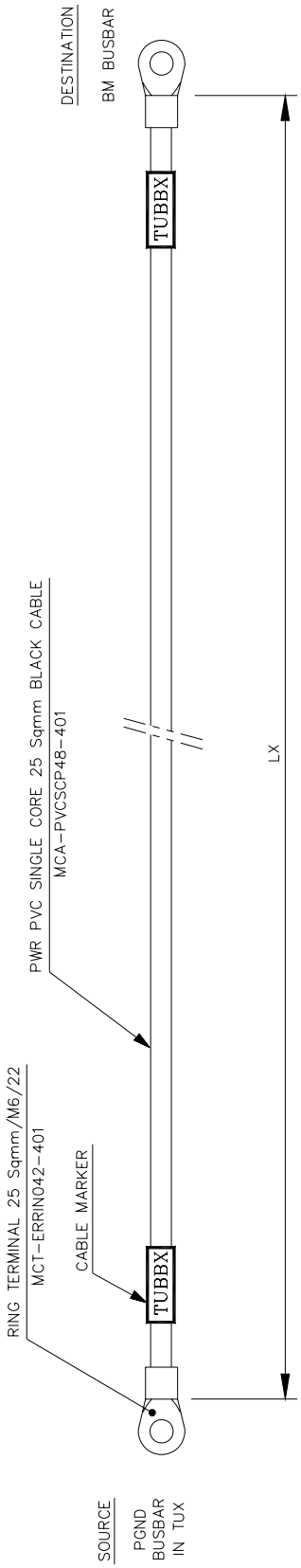


TABLE – 1

CDOT ASSY No.	ACB-MAXTUBBX-000
CABLE PART No.	ACB-MAXTUBBX-000
CABLE MARKER No.	TUBBX
CABLE SPECIFICATION	PWR PVC SINGLE CORE 25 Sqmm BLACK
CABLE LENGTH	LX
SOURCE TERMINATION PART No.	MCT-ERRIN042-401
DESTINATION TERMINATION PART No.	
SOURCE	PGND BUSBAR IN TUX
DESTINATION	BM BUSBAR
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

TABLE – 2

TU No.	LENGTH	CABLE MARKER
1	133 Cms	TUBB0
2	102 Cms	TUBB1
3	58 Cms	TUBB2
4	89 Cms	TUBB3
5	127 Cms	TUBB4
6	155 Cms	TUBB5

NOTE:
1) TXBB: 'X' RANGES FROM 0 TO 5.
2) LX: LENGTH OF THE CABLE. DEPENDS ON THE TU LOCATION IN THE BM.

5.3 FIGURE : BM-PDP PGND CABLE GENERAL ASSEMBLY

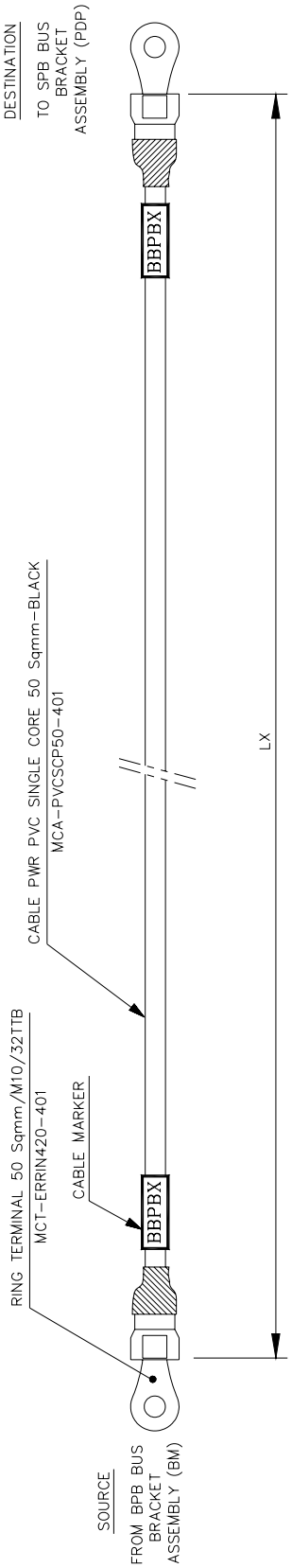


TABLE – 1

CDOT ASSY No.	ACB-MAXBBPBX-000
CABLE PART No.	ACB-MAXBBPBX-000
CABLE MARKER No.	BBPBX
CABLE SPECIFICATION	PWR PVC SINGLE CORE 50 Sqmm-BLACK
CABLE LENGTH	AS GIVEN IN TABLE – 2
SOURCE TERMINATION PART No.	MCT-ERRIN420-401
DESTINATION TERMINATION PART No.	
SOURCE	BPB BUS BRACKET ASSEMBLY-BM
DESTINATION	SPB BUS BRACKET ASSEMBLY-PDP
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

TABLE – 2

SYSTEMS	LENGTH	CABLE MARKER
RSU & MBM	425 Cms	BBPB0
RSU & MBM	570 Cms	BBPB1
RSU & MBM	670 Cms	BBPB2
MBM	770 Cms	BBPB3
MBM	885 Cms	BBPB4
MBM	1000 Cms	BBPB5
MBM	1100 Cms	BBPB6
MBM	1200 Cms	BBPB7

NOTE:

1) BBPBX: 'X' RANGES FROM 0 TO 7. DEPENDING ON THE TU FROM WHICH IT STARTS.

5.4 FIGURE : PDP-EARTH COLLECTOR PLATE PGND CABLE GENERAL ASSEMBLY

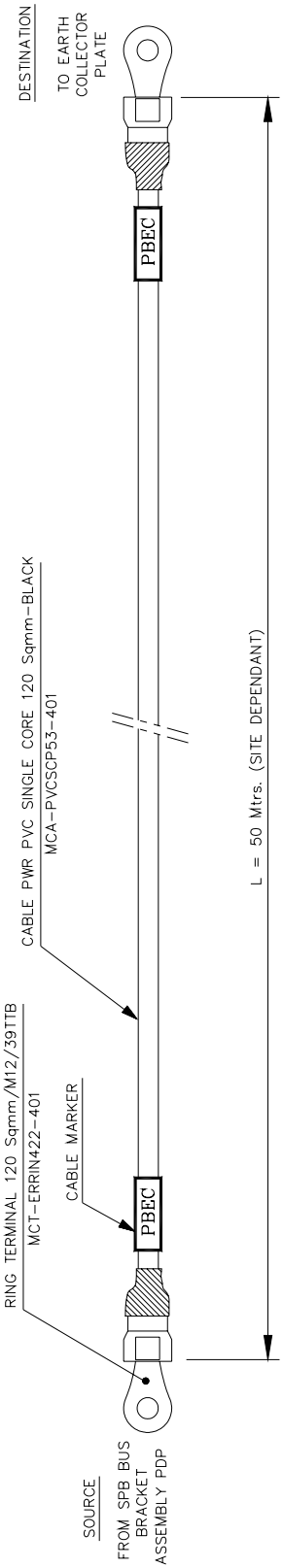


TABLE - 1

CDOT ASSY No.	ACB-MAXPBEC0-000
CABLE PART No.	ACB-MAXPBEC0-000
CABLE MARKER No.	PBEC
CABLE SPECIFICATION	PWR PVC SINGLE CORE 120 Sqmm-BLACK
CABLE LENGTH	50 Mtrs (SITE DEPENDANT)
SOURCE TERMINATION PART No.	MCT-ERRIN422-401
DESTINATION TERMINATION PART No.	
SOURCE	SPB BUSBAR IN PDP
DESTINATION	EARTH COLLECTOR PLATE
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

Chapter 6.

HVP Installation in AN-RAX

6.1. SITE INSPECTION, REQUIREMENTS AND ASSEMBLY PROCEDURE

Before installation of HVP in AN-RAX, various observations are to be made using the Checklist provided in Section 6.2 and the preferred arrangements or values are made available as per the Checklist.

Various parts required for implementing HVP solution in AN-RAX is given in Section 6.3. HVP kit ordering information may be prepared using Partlist given in Section 6.3.

HVP Assembly Procedure in AN-RAX is discussed in Sections 6.4 and 6.5. RS 232 terminal used in AN-RAX is optically isolated using ROI Card to prevent foreign potential entering from the terminal side. Equipping ROI card and routing cables is discussed in Section 6.4. Steps involved in equipping of HVP card, routing ground cables, etc., are discussed in Section 6.5.

6.2. CHECKLIST FOR AN-RAX

The following table provides a checklist for observations in RAX/AN-RAX sites.

Sl. No.	Description		Preferred values wherever applicable	Observations to be recorded in the field/site
1.	Date		DATE OF OBSERVATION TO BE FILLED HERE	
2.	Site name	:	NAME OF THE SITE	
3.	Nos. of lines/systems	:	PROVIDE NO. OF LINES/RAX, AN-RAX	
4.	MDF type	:	DISCONNECTION TYPE	
5.	IPMs used (GDT magazine & External fuse (or) IPM)	:	IPMs TO BE USED	
6.	Quantity of Item No.0 required for equipping on all working lines + spare for the same	:	EQUAL TO NO. OF LINES + SPARES	
7.	Earth Bus Bar present/Not	:	TO BE PRESENT	

Sl. No.	Description		Preferred values wherever applicable	Observations to be recorded in the field/site
	present			
8.	Cable from Earth Bus Bar to Earth Pit	:	TO BE PRESENT	
	Type of the cable	:	BTC 19 / 1.8mm^2	
	Length of the cable (In Meters)	:	LESS THAN 10 METERS	
	Thickness (in sq.mm) of cable	:		
9.	Cable from MDF to Earth Bus Bar	:	TO BE PRESENT	
	Type of the cable / colour	:	SINGLE CORE/ MULTISTRAND COPPER / BLACK	
	Length of the cable (In Meters)	:	LESS THAN 5 METERS	
	Thickness (in sq.mm) of cable	:	25 SQ.MM	
10.	Surge Protector on AC Mains Present /Not present	:	TO BE PRESENT	
11.	Separate AC Earth pit Present/Not present	:	TO BE PRESENT	
12.	Distance between AC earth pit and DC earth pit	:	MORE THAN 100METERS	
13.	GND cable from surge protector to AC earth pit (if present)	:	TO BE PRESENT	
	Type of the cable / colour	:	SINGLE CORE/ MULTISTRAND COPPER / BLACK	
	Length of the cable (In Meters)	:	LESS THAN 6 METERS	
	Thickness (in sq.mm) of cable	:	25 SQ.MM	
14.	Cable from Float charger N48V_GND (or from battery bank GND) to Earth Bus Bar	:	TO BE PRESENT	
	Type of the cable / colour	:	SINGLE CORE/ MULTISTRAND COPPER / BLACK	

Sl. No.	Description		Preferred values wherever applicable	Observations to be recorded in the field/site
	Length of the cable (In Meters)	:	LESS THAN 10 METERS	
	Thickness (in sq.mm) of cable	:	25 SQ.MM	
15.	Cable from Battery Bank to float charger (both N48V and N48V_GND)	:	TO BE PRESENT	
	Type of the cable / colour	:	SINGLE CORE/ MULTISTRAND COPPER / BLUE - RED	
	Length of the cable (In Meters)	:	LESS THAN 10 METERS	
	Thickness (in sq.mm) of cable	:	25 SQ.MM ON EACH LINE	
16.	Cable from Float charger to RAX PDP (both N48V and N48V_GND) through MCB if used	:	TO BE PRESENT	
	Type of the cable / colour	:	SINGLE CORE/ MULTISTRAND COPPER / BLUE - RED	
	Length of the cable (In Meters)	:	LESS THAN 10 METERS	
	Thickness (in sq.mm) of cable	:	25 SQ.MM ON EACH LINE	
17.	RAX GND Bus Bar Present/Not present	:	TO BE PRESENT	
18.	Cable from RAX GND Bus Bar to Earth Bus Bar	:	TO BE PRESENT	
	Type of the cable / colour	:	SINGLE CORE/ MULTISTRAND COPPER / BLACK	
	Length of the cable (In Meters)	:	LESS THAN 6 METERS	
	Thickness (in sq.mm) of cable	:	25 SQ.MM	

Sl. No.	Description		Preferred values wherever applicable	Observations to be recorded in the field/site
19.	Ground Resistance measured/not measured Value if measured	:	TO BE MEASURED PERIODICALLY AND RECORDED TO BE LESS THAN 2-OHMS. SYSTEM SHOULD BE OFF / DISCONNECTED WHILE MEASURING GROUND RESISTANCE	

6.3. PARTLIST FOR OVP FOR AN-RAX SYSTEM

Item No.	Part No.	Description	Specification	Remarks	Size Code	Qty	Unit Code
1.	APC-ROIG03/T-S00	RS-232 OPTO ISOLATOR CARD				01	No.
2.	APC-HVPE44/T-SA1	HIGH VOLTAGE PROTECTION CARD				31*	Nos.
3.	ACB-RAXEBEP0-000	AN-RAX / RAX P-GND CABLE – III				01	No.
4.	ACB-RAXHBHB0-000	HVP BUS BAR LINK CABLE				02	Nos.
5.	ACB-RAXHBEB0-000	AN-RAX / RAX P-GND CABLE-II				02	Nos.
6.	ACB-ANRSTDT1-000	RS232 OPTO ISOLATOR INTERFACE CABLE				01	No.
7.	MAH-VPUNZ040-301	BUS BAR ASSY (HVP)				04	Nos.
8.	MPH-VPUNZ020-201	BUS BAR ISOLATOR (HVP)				04	Nos.
9.	MPH-VPUNZ100-401	MOTHER BOARD SCREW (HVP)				12	Nos.
10.	MPH-VPUNZ090-401	BUS BAR BUSH (HVP)				12	Nos.
11.	MCW-CHSSZ002-401	WASHER PLAIN SST – M2.5				12	Nos.
12.	MCN-HESSM002-401	NUT HEX SST - M2.5				12	Nos.
13.	MCA-MABNZ001-401	CABLE TIE MOUNT - ADHESIVE TYPE				03	Nos.
14.	MCA-CBLTZ000-401	CABLE TIE 75MM (NON RELEASABLE)				05	Nos.
15.	MCC-BPCSZ004-301	EXTENDED LATCH				67	Nos.
16.	MCS-CHSSM089-401	SCR CH HD SST – M6X8				06	Nos.
17.	MCW-CHSSZ007-401	WASHER PLAIN SST – M6				06	Nos.
18.	MCC-BPCSZ002-301	2 X 32 LATCH FRAME				32	Nos.

							TITLE	
							PART LIST FOR OVP FOR ANRAX SYSTEM	
							DOC CODE	NUMBER
							PL	AUN-OVPANR00-000
								SHEET NO: 1 OF 1
								ISSUE : 01
							CENTRE FOR DEVELOPMENT OF TELEMATICS, BANGALORE, INDIA	
ECO. NO.	DATE	ENGR	APPD	PART NO.	ITEM	QTY		
				NEXT ASSY				

Note : * Quantity is same as the number of line cards in the system

6.4. EQUIPPING ROI CARD

The following steps are to be followed to equip the ROI card with ROI interface cable in the AN-RAX system. Please refer Figure 6.6.

1. Remove the already existing ANRAX Dumb terminal interface cable (ACB-ANRSTDT0-000) from the AN-RAX system.
2. RS232 Opto Isolator Interface cable (ACB-ANRSTDT1-000) is routed in the ANRAX system as shown in Figure 6.6.
3. Existing extender latches if available in system can be used to fix the connector modules on the back plane of the AN-RAX system.
4. ROI card is fixed to the dumb terminal as shown in Figure 6.6 and RS232 Opto isolator interface cable is connected to the ROI module as shown in Figure 6.6.

Note : If communication problem is observed when ROI card is used in RS 232 port, ensure that pin 7 of 25 pin connector (RS 232 port) is grounded properly.

6.5. EQUIPPING HVP CARD

For assembly, alongwith the following procedure, please refer to Figures 6.6, 6.7, 6.8 & 6.9.

1. Jack out the cards from slots 3 to 10 and 17 to 24 of the system.
2. Unplug the existing subscriber cables and remove the extended latches from line card slots at rear side of system (cable side).
3. Replace the existing 4-module latch frame (MCC-BPCSZ001-301) at the shroud on the connector A with 2 by 32 latch frame (MCC-BPCSZ002-301).
4. Remove the fixing screws (3 nos.) of the polarizing bar (MPR-AXCBZ104-301) one by one while holding the hex nut on the other side (card side) of motherboard.
5. Fix the HVP bus bar assembly (MAH-VPUNZ040-301) on the rear side (cable side), using the new screws MPH-VPUNZ100-401 and bus bar bushes along with the polarization bar as shown in Figure 6.7. Ensure polarizing bar is aligned properly with the HVP bus bar. Similarly fix the second busbar on the motherboard.
6. Connect two HVP busbars with the HVP busbar cable in Figure 7.1 (ACB-RAXHBHB0-000), at the neighbouring ends with M6x8 screws MCS-CHSSM089-401 and M6 washer MCW-CHSSZ007-401. On one of the busbars connect the PGND cable-II given in Figure 7.2 (ACB-RAXHBEB0-

000) and run it upto the earth busbar of the exchange as shown in the routing diagram given in Figure 6.6.

7. Now place the HVP card (with casing) on connector A of line card slot and then tighten the HVP card lock screw till the card is inserted fully as shown in Figure 6.8. Repeat this for all line card slots.

8. Terminate 2.5 sq.mm cable (P_GND cable) coming from the HVP card, on the respective faston tab provided on the HVP bus bar fixed as shown in Figure 6.8.

9. Fix the latch frames on the HVP cards.

10. Plug the subscriber cables on the HVP card.

11. Follow points 1 to 10 for each TU.

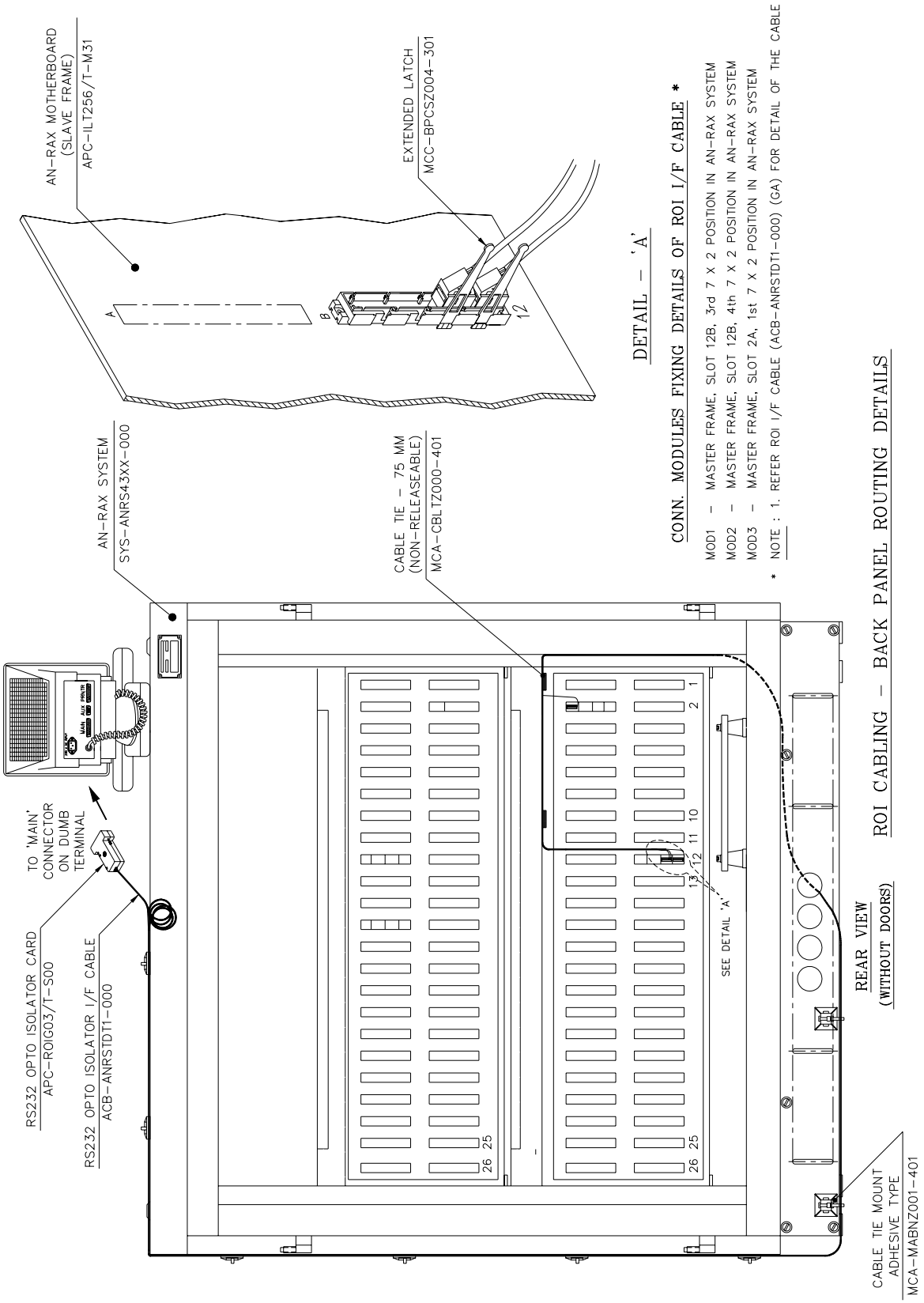
12. Extend the ground from earth collector plate to both TU ground bus bars as shown in Figure 6.9 using cable ACB-RAXHBEB0-000 given in Figure 7.2.

Note :

1. Switch off the N48V feed to the system while fixing the bus bar on the motherboard

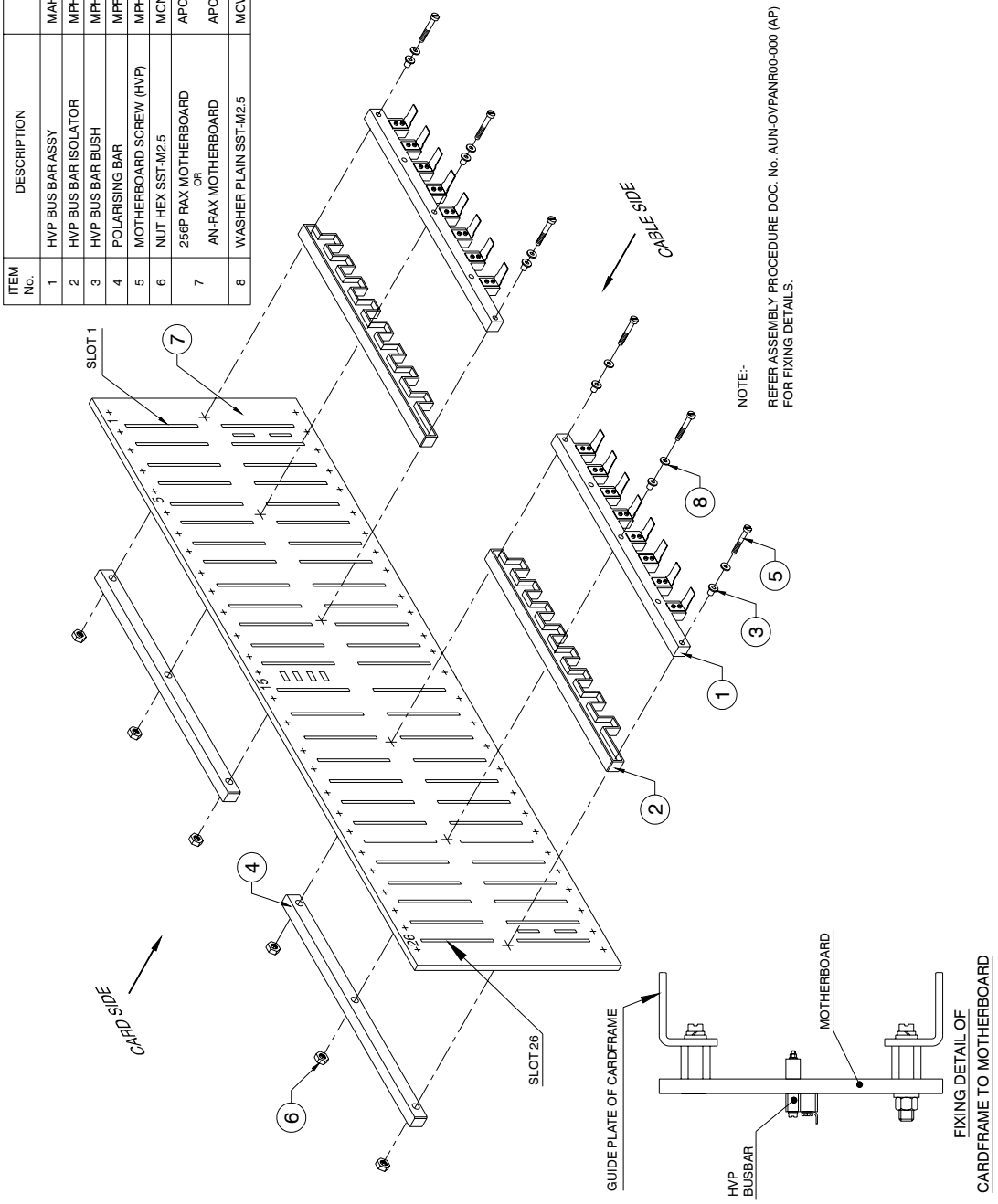
2. Ensure that the Earth bus bar is connected to the earth pit using 19 / 1.8mm^2 BTC wire.

6.6 FIGURE : ROUTING DIAGRAM

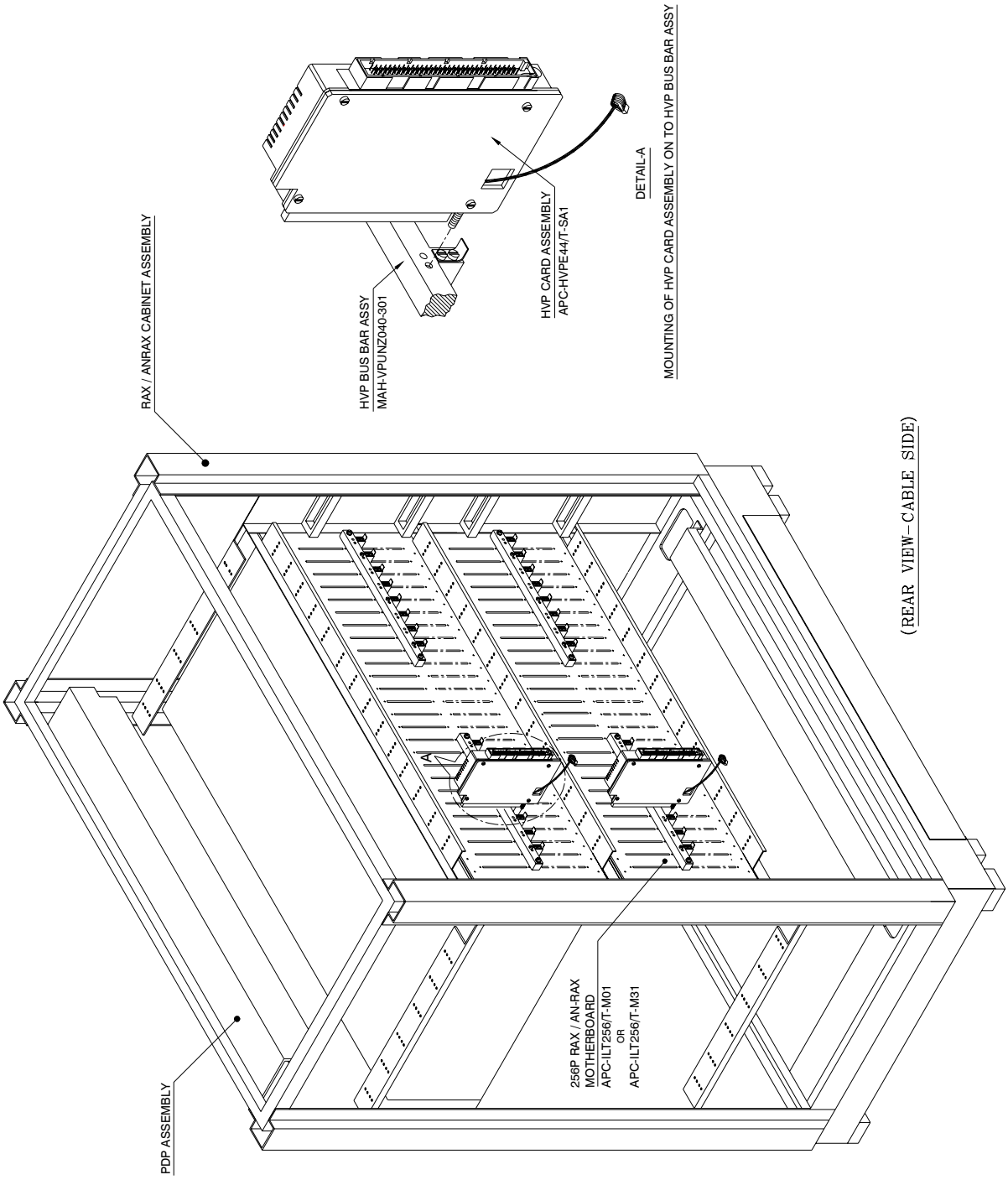

AN-RAX MOTHERBOARD
(SLAVE FRAME)
APC-ILT256/T-M31
EXTENDED LATCH
MCC-BPCSZ004-301
DETAIL – 'A'
CONN. MODULES FIXING DETAILS OF ROI I/F CABLE *
MOD1 – MASTER FRAME, SLOT 12B, 3rd 7 X 2 POSITION IN AN-RAX SYSTEM
MOD2 – MASTER FRAME, SLOT 12B, 4th 7 X 2 POSITION IN AN-RAX SYSTEM
MOD3 – MASTER FRAME, SLOT 2A, 1st 7 X 2 POSITION IN AN-RAX SYSTEM
* NOTE : 1. REFER ROI I/F CABLE (ACB-ANRSTDT1-000) (GA) FOR DETAIL OF THE CABLE
AN-RAX SYSTEM
SYS-ANRS43XX-000
CABLE TIE – 75 MM
(NON-RELEASEABLE)
MCA-CBLTZ000-401
TO 'MAIN'
CONNECTOR
ON DUMB
TERMINAL
RS232 OPTO ISOLATOR CARD
APC-ROIG03/T-S00
RS232 OPTO ISOLATOR I/F CABLE
ACB-ANRSTDT1-000
SEE DETAIL 'A'
REAR VIEW
(WITHOUT DOORS)
ROI CABLING – BACK PANEL ROUTING DETAILS
CABLE TIE MOUNT
ADHESIVE TYPE
MCA-MABNZ001-401

6.7 FIGURE : FIXING OF HVP GROUND BUS BAR IN ATU OF AN-RAX

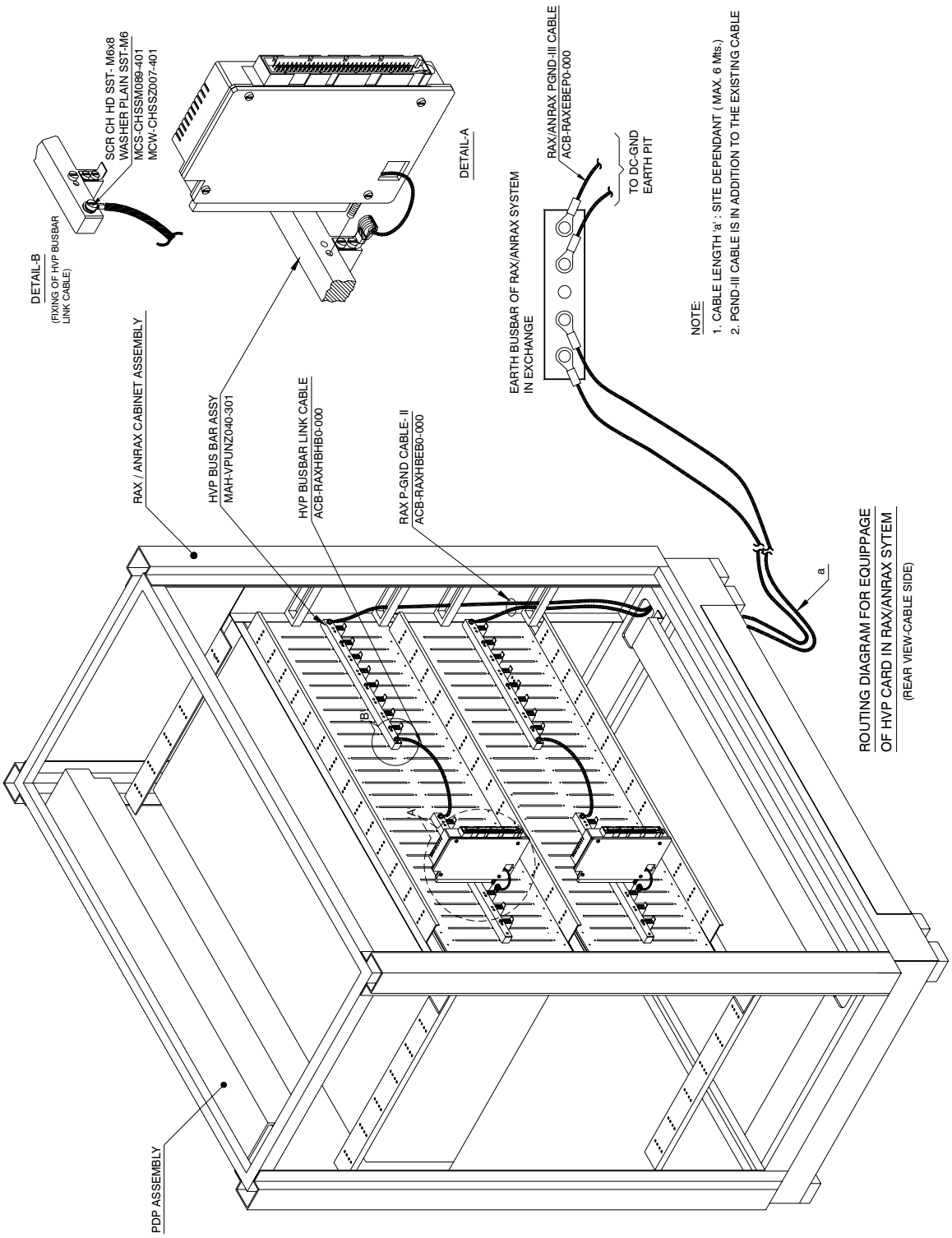
ITEM No.	DESCRIPTION	PART No.
1	HVP BUS BAR ASSY	MAH-VPUNZ040-301
2	HVP BUS BAR ISOLATOR	MPH-VPUNZ020-201
3	HVP BUS BAR BUSH	MPH-VPUNZ090-401
4	POLARISING BAR	MPR-AXCBZ104-301
5	MOTHERBOARD SCREW (HVP)	MPH-VPUNZ100-401
6	NUT HEX SST-M2.5	MCN-HESSM002-401
7	256P RAX MOTHERBOARD OR AN-RAX MOTHERBOARD	APC-ILT256/T-M01 OR APC-ILT256/T-M31
8	WASHER PLAIN SST-M2.5	MCW-CHSSZ002-401



6.8 FIGURE : FIXING OF HVP CARD IN ATU OF AN-RAX



6.9 FIGURE : ROUTING AND TERMINATION OF GROUND CABLES IN AN-RAX



Chapter 7.

Cable Diagrams for AN-RAX

This chapter gives information on various ground cables used in C-DOT AN-RAX during HVP installation.

The following figures may be referred for assembly instructions for ground cables used in AN-RAX systems:

7.1	Figure	→	HVP bus bar link cable (used for shorting two ground bars in ATU).
7.2	Figure	→	AN-RAX / RAX P-GROUND CABLE-II (used for extending ground from Exchange earth collector plate to HVP bus bar in ATU of AN-RAX).
7.3	Figure	→	RS 232 OPTO ISOLATION INTERFACE CABLE (used for isolation of Terminal RS 232 interface from system).

7.1 FIGURE : HVP BUS BAR LINK CABLE

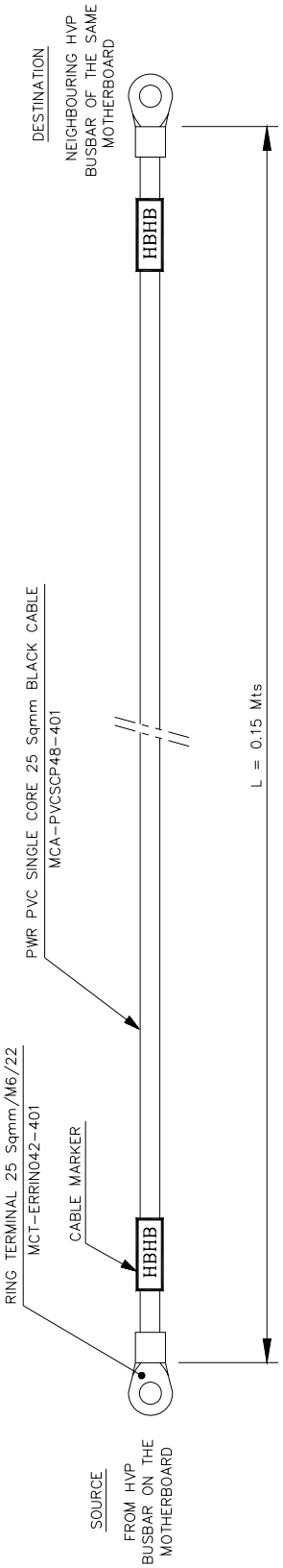


TABLE - 1

CDOT ASSY No.	ACB-RAXHBHB0-000
CABLE PART No.	ACB-RAXHBHB0-000
CABLE MARKER No.	HBHB
CABLE SPECIFICATION	PWR PVC SINGLE CORE 25 Sqmm BLACK
CABLE LENGTH	L = 0.15 Mtrs
SOURCE TERMINATION PART No.	MCT-ERRIN042-401
DESTINATION TERMINATION PART No.	
SOURCE	HVP BUSBAR ON THE MOTHERBOARD
DESTINATION	NEIGHBOURING HVP BUSBAR OF THE SAME MOTHERBOARD
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

7.2 FIGURE : AN-RAX/RAX P-GROUND CABLE-II

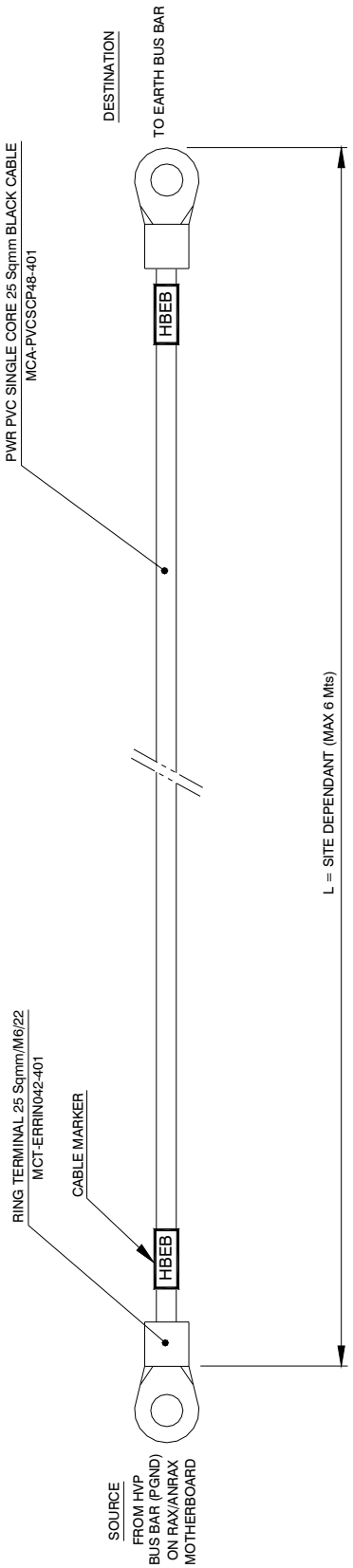


TABLE - 1

CDOT ASSY No.	ACB-RAXHBEB0-000
CABLE PART No.	ACB-RAXHBEB0-000
CABLE MARKER No.	HBEB
CABLE SPECIFICATION	PWR PVC SINGLE CORE 25 Sqmm BLACK CABLE
CABLE LENGTH	SITE DEPENDANT
SOURCE TERMINATION PART No.	MCT-ERRIN042-401
DESTINATION TERMINATION PART No.	
SOURCE	HVP BUS BAR (PGND) ON RAX/ANRAX MOTHERBOARD
DESTINATION	TO EARTH BUS BAR
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

7.3 FIGURE : RS 232 OPTO ISOLATOR I/F CABLE GENERAL ASSEMBLY

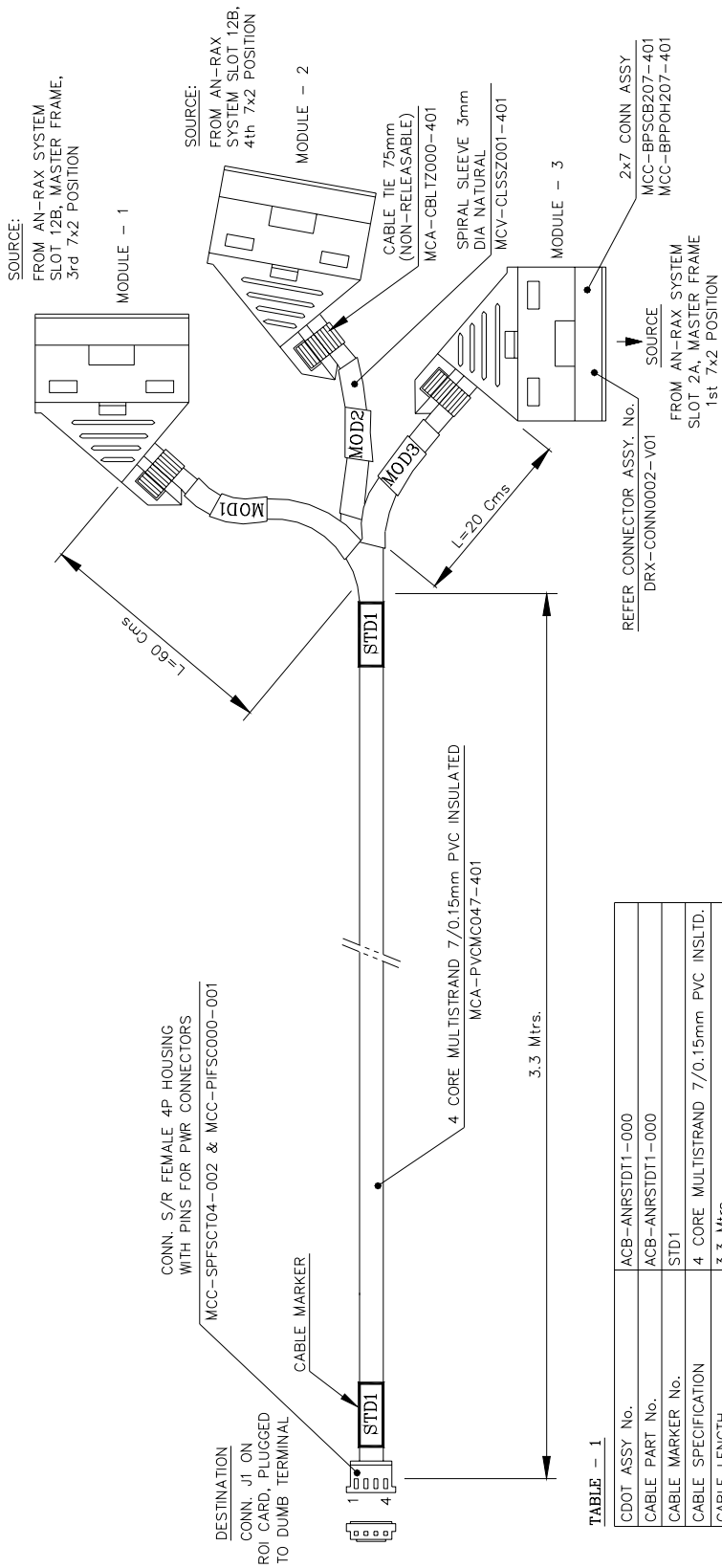


TABLE - 1

CDOT ASSY No.	ACB-ANRSTD11-000
CABLE PART No.	ACB-ANRSTD11-000
CABLE MARKER No.	STD1
CABLE SPECIFICATION	4 CORE MULTISTRAND 7/0.15mm PVC INSLTD.
CABLE LENGTH	3.3 Mtrs
SOURCE TERMINATION PART No.	DRX-CONN0002-V01
DESTINATION TERMINATION PART No.	MCC-SPFSCT04-002 & MCC-PIFSC000-001
SOURCE	FROM AN-RAX SYSTEM
DESTINATION	CONN. J1 ON ROI CARD
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

WIRING DETAILS

SYSTEM (SOURCE) SIDE					8 PAIR CABLE		DESTINATION ON SIDE	CABLE MARKER
SIGNAL NAME	7x2 MODULE 1	7x2 MODULE 2	7x2 MODULE 3	CABLE MARKER	COLOUR CODE	LENGTH OF CABLE	LENGTH OF SLEEVE	ROI CARD CONN. J1	
ARC_ROI_SER_DATA	a6	-	-	MOD1	YELLOW	3.3 Mts	0.6 Mts	PIN 1	STD1
ROI_ARC_SER_DATA	c6	-	-	MOD1	GREEN	3.3 Mts	0.6 Mts	PIN 2	
GND	-	-	a7	MOD3	BLACK	2.9 Mts	0.2 Mts	PIN 3	
Vcc	-	a7	-	MOD2	RED	3.3 Mts	0.6 Mts	PIN 4	

RO
W

Chapter 8.

Test Procedure for HVP Card

This chapter deals with test procedure to be followed for testing HVP cards.

8.1. TESTING HVP CARD

This section deals with test procedure to be followed for High Voltage Protection Card before using it. The sequence of steps mentioned in this section helps to detect fault in components used of specific nature, i.e., short between TIP AND/OR Ring to ground in a GD Tube, etc. However, actual environment for testing functionality cannot be simulated easily and with this test, it can be assumed that devices operate properly, if no faults are detected.

8.2. DETAILED TEST PROCEDURE

Please refer to figures 8.3, 8.4 & 8.5. The following test procedure is described with reference to subscriber port 1. Same sequence should be followed while checking the other ports also. The correspondence between the signals of the respective ports and the pins on the connector is provided in table-1. Refer the circuit schematics of HVP card: APC-HVPE44/T-SA1 (CS) given in Figure 8.3.

1. Check the following :

   a. The resistance between the points T1 (a2/A1) and PT1 (a2/A2) should be in the range of 20±20% ohms at an ambient temperature of 25°C.

   b. The resistance between the points R1 (c2/A1) and PR1 (c2/A2) should be in the range of 20±20% ohms at an ambient temperature of 25°C.

   c. Check for the difference in resistance values on TIP and RING links of the port. It should not exceed 0.5Ω.

   d. All points T1, R1, PT1 and PR1 should show high impedance (of the order of Mega ohms, with PGND).

2. If the resistance between the points T1 and PT1 or R1 and PR1 is more than the value mentioned at 1 (a) or 1 (b), then replace the corresponding PTC.

3. If any of the points T1, PT1, R1 and PR1 shows low resistance with PGND, then lift up one pin of the PTC and check for the resistance again.

If the low value of resistance still persists,

a. If it is with T1 to PGND or R1 to PGND, then replace the GDT.

b. If it is with PT1 to PGND or PR1 to PGND, then replace the TRISIL.

TABLE-1

PORT NO. / SIGNAL	1	2	3	4	5	6	7	8
T	a2/A1	a3/A1	a4/A1	a5/A1	a6/A1	a7/A1	a8/A1	a10/A1
R	c2/A1	c3/A1	c4/A1	c5/A1	c6/A1	c7/A1	c8/A1	c10/A1
PT	a2/A2	a3/A2	a4/A2	a5/A2	a6/A2	a7/A2	a8/A2	a10/A2
PR	c2/A2	c3/A2	c4/A2	c5/A2	c6/A2	c7/A2	c8/A2	c10/A2

Note :

1. In general, the GDT and the TRISIL fail by short circuit. Special equipments are needed for checking the correct functionality of GDT and TRISIL.
2. It is recommended to visually inspect the card before following the above test procedure.

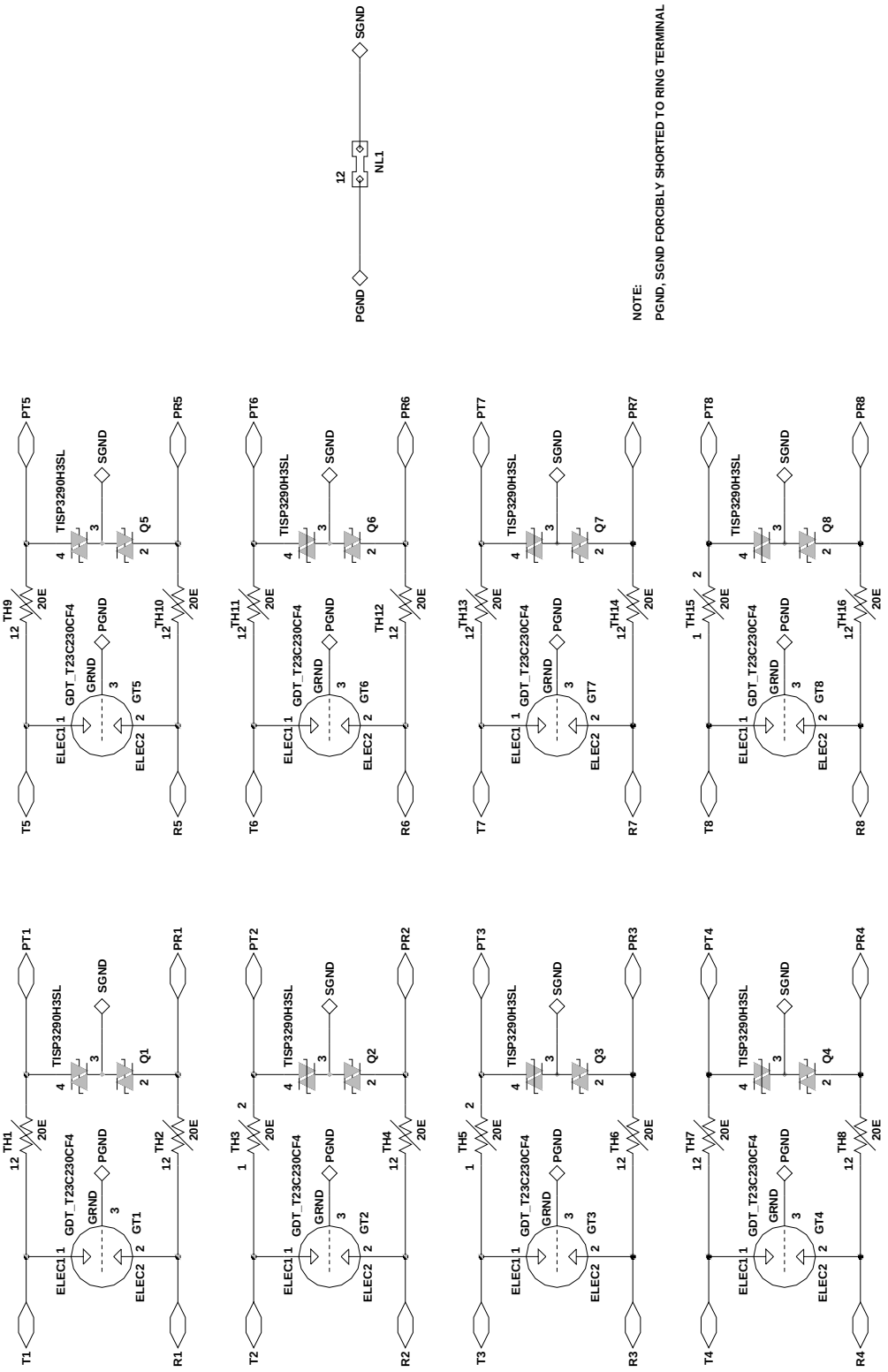
Requirements for testing and repair

1. Digital multimeter
2. Soldering Iron and the relevant accessories.
3. Components used in HVP cards and their part code is given in Section 8.6.

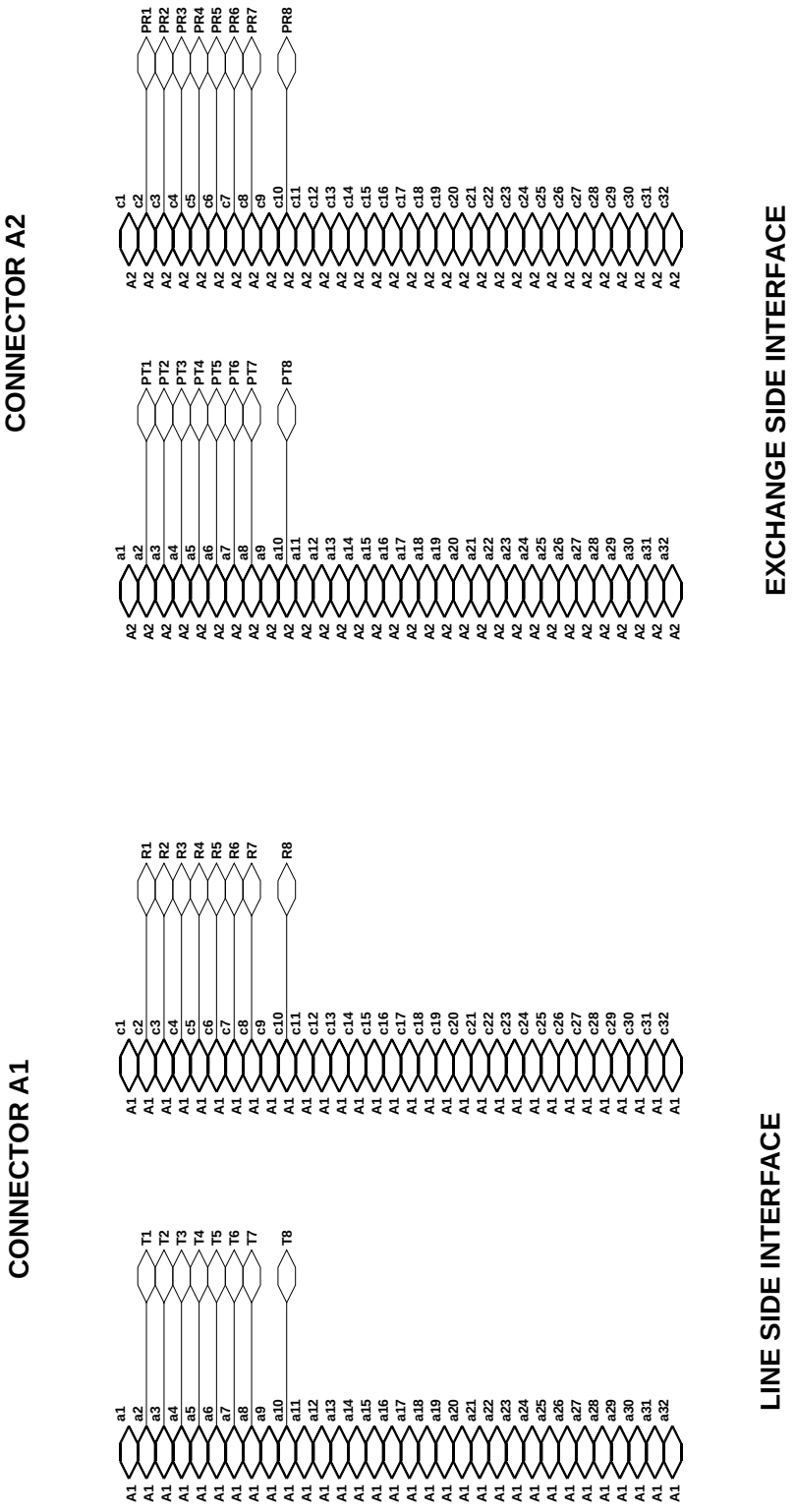
Reference documents

1. Circuit Schematics of HVP card (APC-HVPE44/T-SA1(CS)) given in Figure 8.3.

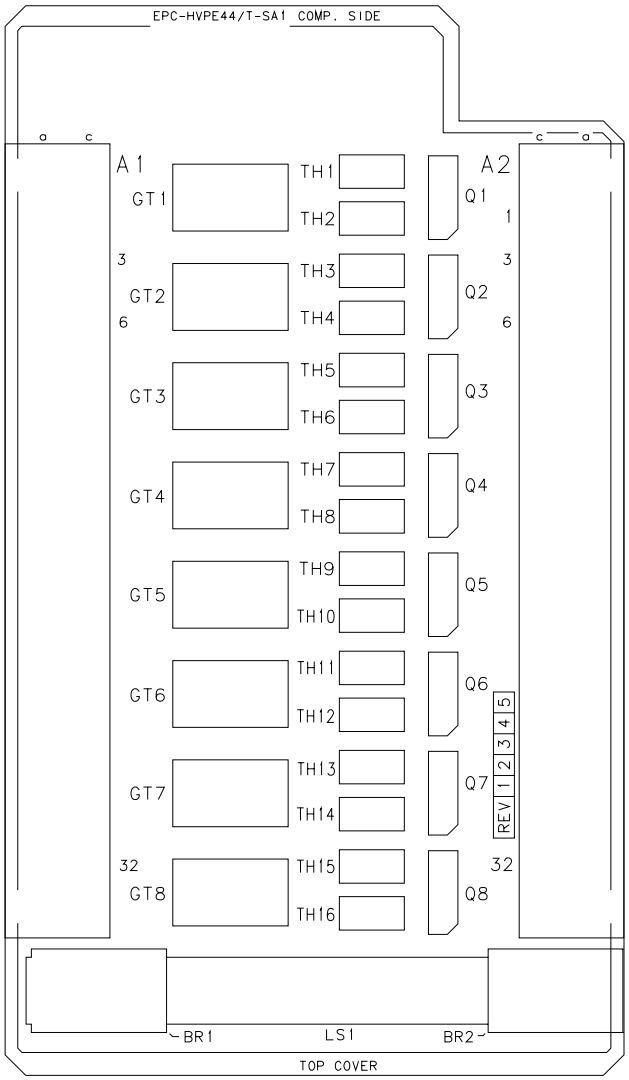
8.3. FIGURE : CIRCUIT SCHEMETICS FOR HVP CARD



8.4. FIGURE : CONNECTOR PIN ASSIGNMENT FOR HVP CARD



8.5. FIGURE : COMPONENT PLACEMENT CHART FOR HVP CARD



NOTE :

1. THE DIFFERENCE IN THE RESISTANCE VALUES OF THE PTCs USED ON THE TIP AND RING LIMBS OF A PORT SHOULD NOT EXCEED 0.5 OHMS i.e BETWEEN TH1 & TH2, TH3 & TH4 ETC.

8.6. COMPONENT LIST FOR HVP CARD

8.6.1. Resistors

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	TH1-TH16	A	ERT-E0060025-100	PTC THERMISTORS	16

8.6.2. Diodes

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	GT1-GT8	A	ESP-GDT00001-000	3 ELEMENT GD TUBE WITH FAIL SAFE MECH.	08

8.6.3. Transistors

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	Q1-Q8	A	EDT-THBT200D-190	200V, BIDIR TRISIL (SIP3)	08

8.6.4. Mechanical

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	A1	A	MCC-SUMRST64-001	CONN STD EURO 64P MALE R/A GOLD	01
a.		C	MCS-CHSSM019-401	SCR CH HD SST M2.5x12.0	02
b.		C	MCN-HESSM002-401	NUT HEX SST M2.5	02
c.		C	MCW-SPSTS001-401	WASHER SPR STL M2.5	02
d.		C	MCC-BPCSZ001-301	4 MODULE LATCHING FRAME CON	01
2.	A2	A	MCC-EURVF000-302	CONN REV EURO 64P FML TINLEAD PLTD	01
a.		C	MCS-CHSSM019-401	SCR CH HD SST M2.5x12.0	02
b.		C	MCN-HESSM002-401	NUT HEX SST M2.5	02
c.		C	MCW-SPSTS001-401	WASHER SPR STL M2.5	02
3.		C	MPH-VPUNZ000-201	TOP COVER (HVP)	01

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
4.		C	MPH-VPUNZ010-201	BOTTOM COVER (HVP)	01
a.		C	MCS-CHSSM019-401	SCR CH HD SST – M2.5x12	04
5.	BR1	A	MPH-VPUNZ070-401	HVP PCB BRACKET – FRONT	01
a.		C	MCS-CHSSM016-401	SCR CH HD SST M2.5x6	02
b.		C	MCW-CHSSZ002-401	WASHER PLAIN SST – M2.5	02
6.	BR2	A	MAH-VPUNZ060-301	HVP PCB BRACKET ASSY. – REAR	01
a.		C	MCS-CHSSM023-401	SCR CH HD SST M3x6	01
b.		C	MCS-CHSSM016-401	SCR CH HD SST M2.5x6	01
c.		C	MCW-CHSTN003-401	WASHER PLAIN STL M3	01
d.		C	MCW-CHSSZ002-401	WASHER PLAIN STL M2.5	01
7.	LS1	A	MPH-VPUNZ080-401	HVP PCB BRKT SCREW	01
8.	RT1		MCA-PVCSCP43-401	PWR PVC SINGLE CORE 2.5 SQMM BLACK	10 CMS
a.			MCT-ERRII011-401	RING TERMINAL 2.5 SQMM M3/14.5	01
b.			MCC-FASTP001-401	FASTON RECEPTACLE	01
c.			MCC-FASTP002-401	INSULATION BOOT	01

8.6.5. Miscellaneous

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	PCB	A	EPC-HVPE44/T-SA1	HIGH VOLTAGE PROTECTION CARD BARE PCB	1

Chapter 9.

Test Procedure for ROI Card

This chapter deals with testing procedure to be followed for ROI Card.

9.1. FUNCTIONAL SPECIFICATION

ROI card is designed to be used with AN-RAX system and can be used wherever isolated serial RS232 communication is required. This card acts as an interface card between ARC card (in AN-RAX system) and dumb terminal for RS232 communication. This card should draw power from the AN-RAX system through a cable. Also the RS232 signals of the ARC card should be given to the ROI card through the same cable. The ROI card should interface with the dumb terminal using 25-pin right-angled D-type connector. This card should be able to work in NON-AC environment.

ROI card uses female 25 pin D type connector. If dumb terminal uses female 25 pin D type connector for RS 232 communication, suitable female-male adapter may be used.

9.2. GENERAL DESCRIPTION

The ROI card has mainly two sections.

i) Isolated power generation section.

ii) RS232 signal isolation section.

Isolated power generation section consists of a transformer driver, full wave rectifier and a 5V regulator circuit. The MAX253 is an isolated power-supply transformer driver has been used as transformer driver. The MAX253 consists of an RC oscillator followed by a toggle flip-flop, which generates 50% duty cycle square waves. This generated square wave is given to a center tapped full wave rectifier circuit, which consists of a transformer, rectifying diodes and filtering capacitors. A linear regulator is used to regulate the output voltage to 5V. The output of the regulator is completely isolated 5V from that of input Vcc (5V). An LED is provided on the board to indicate the status of isolated 5V.

RS232 signal isolation section has mainly RS232 driver/receiver, Opto isolators with an inverter device. The RS232 driver/receiver generates RS232 voltage levels from a single power supply. Two RS232 transceivers are used, in which one works with

input 5V power and the other works on isolated 5V generated on board. Two Opto couplers with inverter are used to isolate the RS232 transmit and receive signals. With this ROI card, maximum 19200 bps serial data can be transmitted without any distortion.

9.3. DETAILED TEST PROCEDURE

Test setup may be made as given in Figure 9.5. Please refer to Sections 9.6 to 9.11 for ROI Tester Power Supply & Loop back cable, Partlist for ROI Power Supply & Loopback cable, Circuit Schematics, Connector Pin Assignments, Component Placement Chart (Component side) and Component Placement Chart (Solder side).

1. Inspect the card visually that all the components are properly soldered and mounted as per the component list {(APC-ROIG03/T-S00 (CL), excluding the enclosure}.

2. Test for any short between VCC & GND, I_VCC & I_GND.

3. Resistance between VCC & GND should be very high (in order of Mega Ohms) and I_VCC & I_GND should be around 430 Ohms after assembly of all the components as per CL.

4. ROI tester cable (ACB-ROIRODT0-000) is to be used for testing of the ROI card.

5. Assembled ROI card (without ROI enclosure) is fixed to a working VT 100 terminal or a PC, which has Hyperterm or XTALK or Teraterm software.

6. Power on the VT 100 terminal or PC and also Power up the unit supplying 5V to the ROI through the tester cable.

7. Check for the I_VCC indication LED. If the LED is not glowing, then perform the following steps:

   a) Measure the voltage between pins 6 & 2,7 of MAX253 device (U2) with DMM. If 5V is not available, then check for trace short between pin 4 of J1 and pin 6 of U2, pin 3 of J1 and pins 2 & 7 of U2 for checking VCC and GND path from connector J1 and U2.

   b) If the voltage to the MAX253 device is proper, check the voltage waveform between pin 1 and 8 of MAX253 (U2) device or pins 1 and 3 of transformer (T1) using a CRO. It should be a square wave of amplitude 12V (maximum) peak to peak and of frequency 350KHz. If square wave is not found, MAX253 device pin to pad connectivity may not be proper. Check each pin to pad connectivity. If the connectivity is proper, then MAX253 device may be assumed faulty, can be replaced and tested again.

c) If the wave is proper then check voltage at the cathode pins of diodes CR2, CR3 with reference to I_GND point. The voltage should be around 8V. If the voltage is not around 8V, then transformer T1 or diodes CR2 or CR3 may be faulty. Replace them with another ones and test again.

d) If the voltage at cathode pins of CR2 and CR3 is 8V, then check the voltage at the input pin (pin 3) of voltage regulator VR1, which should be at same potential as that of cathodes of CR2 and CR3. If the voltage is same then check the voltage at output (pin 2) of voltage regulator VR1. It should be 5V. If the voltage is not 5V, check for resistor values of R2 and R3. The values of R2 and R3 are R2 = 330 Ohms and R3 = 110 Ohms. Voltage at pin 1 of voltage Regulator should be at 1.25V. If the Resistors R2 and R3 are proper and voltage at pin 1 is not at 1.25V, then voltage regulator can be considered as faulty. Replace the voltage regulator with another and test again.

e) If the I_VCC is at 5V and still LED is not glowing, then check the polarity of LED, whether it is properly assembled with proper polarity or not. If properly assembled check for the resistor R6. It should be of 330 Ohms resistor.

9.4. RS232 PORT TESTING

For RS232 port testing, verify visually the loop back at the pins 1 and 2 of the ROI tester cable connector. Data rates and settings required for RS232 communications in the VT100 or PC used for testing should be done properly.

Open XTALK (Hyperterm or Teraterm) window in case of PC. Type some character on the keyboard of the PC or VT100 terminal used for testing. The same character should be visible on the screen. If character is not visible then the following tests are to be done.

1. Check whether all the devices on the board are getting proper VCC & GND voltages (on U1, U2, U3 and U4) and proper I_VCC & I_GND (on U5 & U6).

2. If all the devices are getting proper power and check for the both transmit and receive paths of RS232 on the card.

3. Check at pin 13 of U6 using CRO. The signal should be ±12V leveled signal or should be pulsing when any character is typed on keyboard. If the signal is not appearing at pin 13, check for resistor R1, which should be at 0 Ohms.

4. Check at pin 12 of U6 using CRO, which should be pulsing at 5V when any character is typed on keyboard. If the signal is present at pin 12 and not present on pin 13 of U6 when character is typed on keyboard, U6 can be assumed faulty. Replace U6 and test it again.

5. If U6 is proper and typed character is not appearing on screen, check for R8, R9 which should be 390 Ohms, 3.3KOhms respectively. Check signals at pin 1 and pin 5 of opto coupler U4 using CRO. If signal is present at pin 1 and not present at pin 5 of U4, opto coupler U4 may be faulty. Replace U4 and test again.

6. If U4 is working proper and typed character does not appear check for U3 at pin 3 and pin 4 using CRO. If signal is present at pin 3 and not present at pin 4 of U3, then 74ABT04, U3 can be faulty. Replace the device and check for RS232 communication.

7. If 74ABT04, U3 is also proper, check for DS232, U1. Check for signal at pin 12 of U1 using CRO. If signal is present at pin 11 and not present at pin 14, then U1 can be faulty. Replace the device and test for RS232 communication.

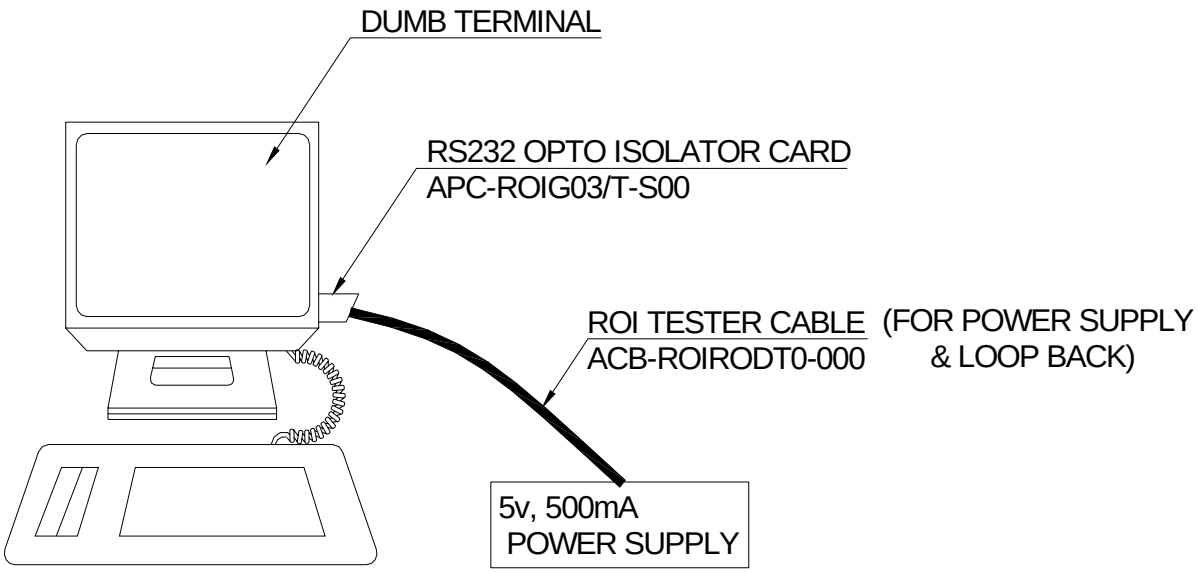
8. If signal is appearing at pin 14 of U1, the same signal should appear at pin 13 as it is looped back. If signal is not appearing, check for R12, which should be at 0 Ohms. If signal is appearing pin 13, check at pin 12. If signal is appearing at pin 13 of U1 and not appearing at pin 12 of U1, the device U1 can be assumed faulty. Replace the device and test again.

9. If U1 is working proper, then check for U3 at pin 1 and pin 2 using CRO. If signal is present at pin 1 and not present at pin 2 of U3, then 74ABT04, U3 can be faulty. Replace U3 and test again.

10. If 74ABT04(U3) is working properly, check for resistors R7 and R4, which should be 390 Ohms and 3.3KOhms respectively. Check at pin 1 and pin 5 of opto coupler U5 using CRO. If signal appears at pin 1 and does not appear at pin 5, opto coupler U5 can be faulty. Replace U5 and test again.

11. If opto coupler is also working properly and still typed character does not appear on screen, check at pin 11 and 14 of U6 using CRO. If signal present at pin 11 of U6 and not present at pin 14, U6 can be faulty. Replace U6 and test again.

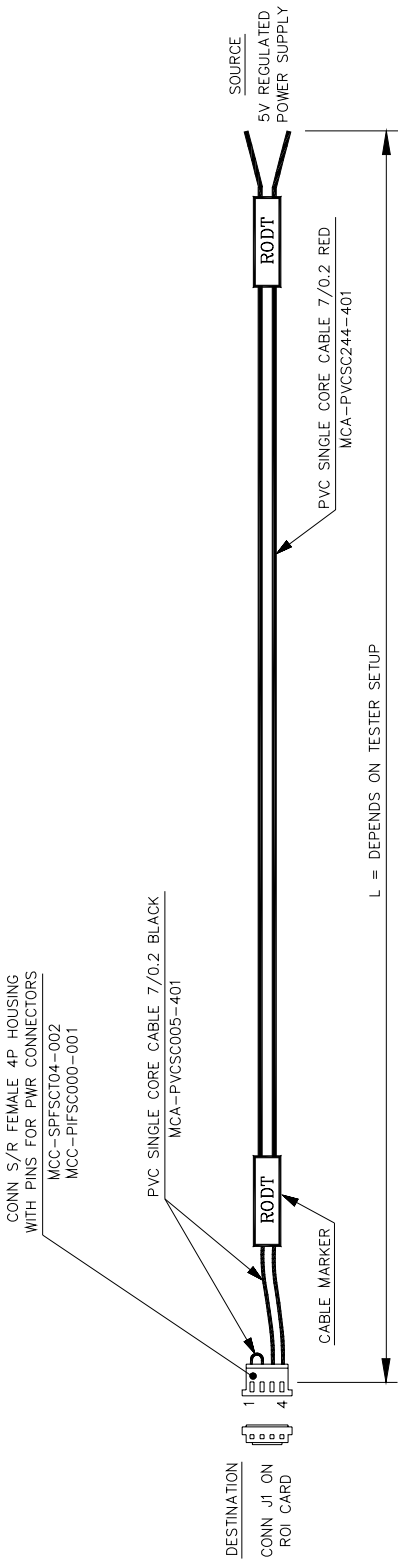
9.5. TEST SETUP



Equipments Required

1. 5V, 500mA, Regulated Power supply
2. Dumb terminal
3. CRO
4. Digital Multi Meter (DMM)

9.6. FIGURE : ROI TESTER CABLE (FOR POWER SUPPLY AND LOOP-BACK)



WIRING DETAILS

SIGNAL NAME	SOURCE	DESTINATION ON J1
ARC_ROI_SER_DATA	PIN 2 ON J1 OF ROI CARD	PIN 1 ON J1 OF ROI CARD
ROI_ARC_SER_DATA	PIN 1 ON J1 OF ROI CARD	PIN 2 ON J1 OF ROI CARD
GND	POWER SUPPLY	PIN 3
Vcc	POWER SUPPLY	PIN 4

TABLE - 1

CDOT ASSY No.	ACB-ROIRODT0-000
CABLE PART No.	ACB-ROIRODT0-000
CABLE MARKER No.	RODT
CABLE SPECIFICATION	PVC SINGLE CORE CABLE 7/0.2 BLACK PVC SINGLE CORE CABLE 7/0.2 RED
CABLE LENGTH	DEPENDS ON TESTER SETUP
SOURCE TERMINATION PART No.	-
DESTINATION TERMINATION PART No.	MCC-SPFSCT04-002 MCC-PIFSC000-401
SOURCE	5V, 500mA REGULATED POWER SUPPLY
DESTINATION	CONN. J1 ON ROI CARD
ASSEMBLY PROCEDURE	AS PER ABOVE DRAWING

9.7. PART LIST FOR ROI TESTER CABLE ASSEMBLY (FOR POWER SUPPLY & LOOPBACK)

Item No.	Part No.	Description	Specification	Remarks	Size Code	Qty	Unit Code
1.	MCC-SPFSCT04-002	CONN S/R FEMALE 4P HOUSING CON		SA		01	No.
2.	MCC-PIFSC000-001	PINS FOR PWR CONNECTOR		SA		04	Nos.
3.	MCA-PVCSC005-401	PVC SINGLE CORE CBL 7/0.2 BLACK		#		02	Nos.
4.	MCA-PVCSC244-401	PVC SINGLE CORE CBL 7/0.2 RED		*		01	No.
5.	RODT	CABLE MARKER				02	Nos.

ECO. NO.	DATE	ENGR	AP PD	PART NO.	ITEM	QTY
				NEXT ASSY		

TITLE

Chapter

DOC CODE	NUMBER	SHEET NO:
PL	ACB-ROIRODT0-000	1 OF 1
		ISSUE : 01

CENTRE FOR DEVELOPMENT OF TELEMATICS, BANGALORE

Note:

\# One cable length should be 25mm (for loopback) and other cable length depends on tester setup (for ground signal).

* Length of cable depends on Tester setup.

9.8. CIRCUIT DESCRIPTION FOR ROI CARD

This circuit can be functionally divided in to two sections. One is Isolated Power generation Section and the other is RS232 signal isolation circuit.

Isolated Power Generation Section

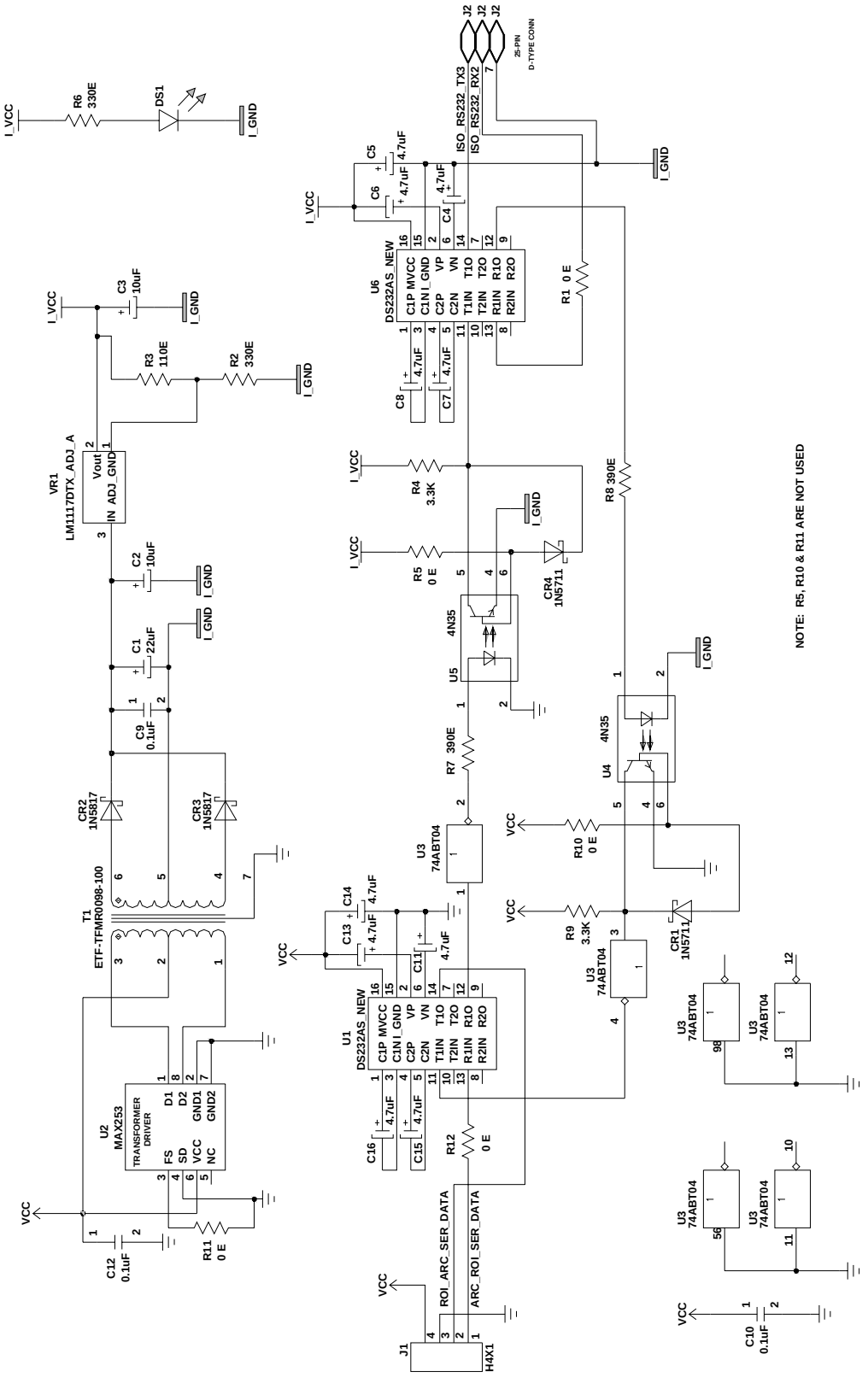
This block has transformer driver MAX253, transformer, a full wave rectifier, filter circuit and a regulator circuit. 5V and Ground are given to board through the connector J1. The MAX253 consists of an RC oscillator followed by a toggle flip-flop. This generates two square waves of out-of-phase at half the oscillator frequency, which is fed to transformer primary. Pin SD (Pin no: 4) should be grounded for normal operations. When SD is high, it disables all the internal circuitry including oscillator. Pulling pin FS (pin no: 3) of MAX253 low reduces the oscillator frequency and lowers the supply current. The generated square wave is given to a center tapped full wave rectifier circuit, which consists of a transformer, rectifying diodes and filtering capacitors. The transformer used is a center tapped on both primary and secondary side. Diodes (CR2 & CR3) and filtering capacitors (C9 & C1) are used for converting square wave to DC signal. This DC signal is fed to a regulator, which regulates the output to 5V. An LED indicator has been provided to indicate the status of the generated isolated 5V (I_VCC).

RS232 Signal Isolation Section

This section isolates the input serial data path to the output serial data path. This card gets serial transmit and receive signals from connector J1. The receive signal (ARC_ROI_SER_DATA) from connector J1 is fed to RS232 transceiver (DS232AS), which converts input signal to suitable voltage level. After conversion of the signal to suitable voltage level, the signal is fed to an inverter and then to Opto isolator. Opto isolator 4N35 inverts the RS-232 serial signal. In order to have the proper phase of the signal, inverter is used. Again the signal is passed through RS232 transceiver, which works on isolated VCC and isolated GND. After converting the receive signal to proper line side voltage level, the signal is given out through 25-pin D-type connector J2 which will be connected to dumb terminal usually. The same way transmit signal also gets isolated.

ROI card is guaranteed for operation speeds upto 19200 bits per second with out any distortion.

9.9. FIGURE : CIRCUIT SCHEMATICS FOR ROI CARD



9.10. CONNECTOR PIN ASSIGNMENT FOR ROI CARD

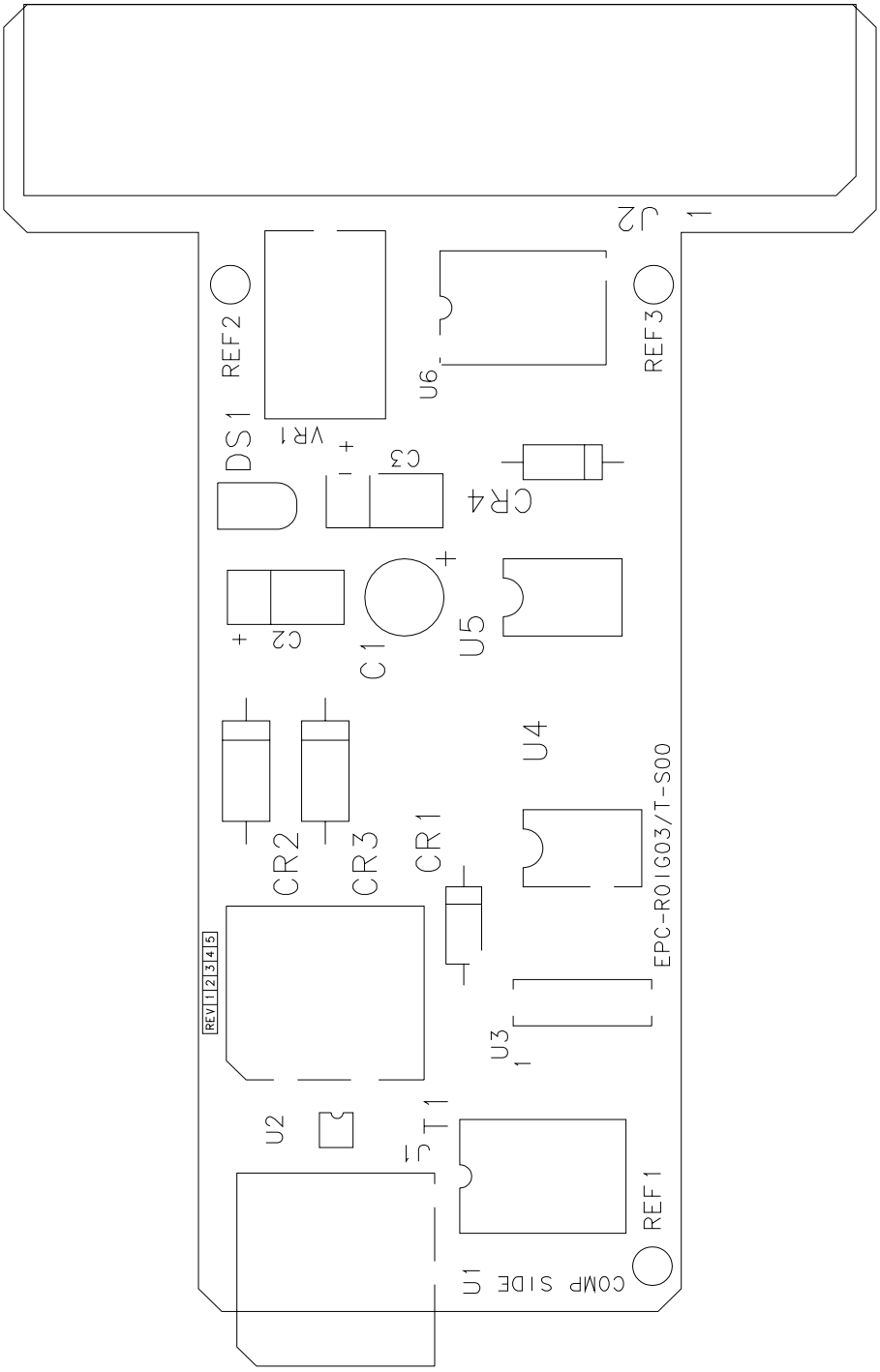
CONNECTOR J1

PIN NO	SIGNAL NAME	REMARKS
1	ARC_ROI_SER_DATA	I
2.	ROI_ARC_SER_DATA	O
3.	GND	P
4.	VCC	P

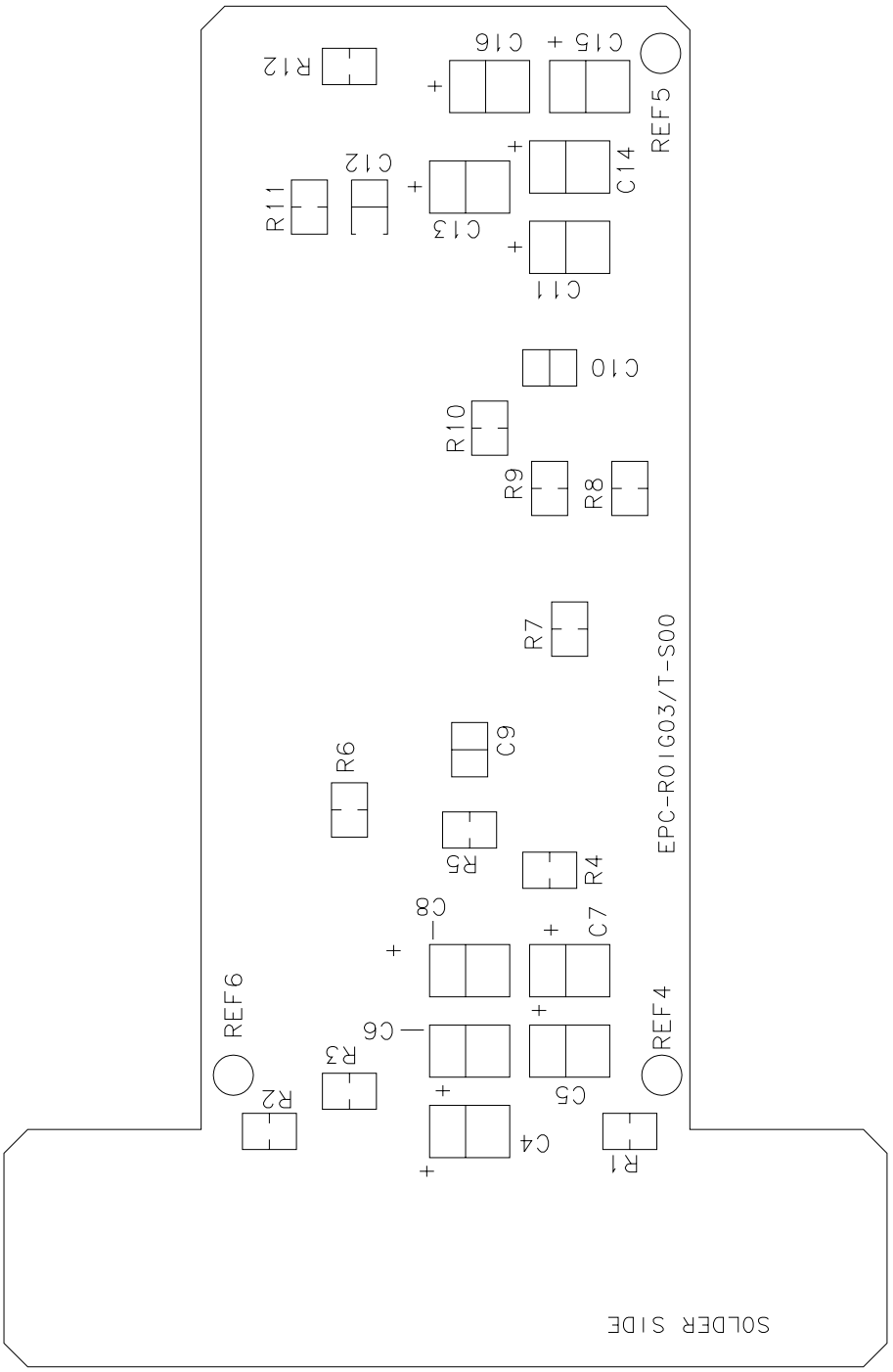
CONNECTOR J2

PIN NO	SIGNAL NAME	REMARKS
2	ISO_RS232_RX	I
3	ISO_RS232_TX	O
7	I_GND	P

9.11. FIGURE : COMPONENT PLACEMENT CHART FOR ROI CARD (COMPONENT SIDE)



9.12. FIGURE : COMPONENT PLACEMENT CHART FOR ROI CARD (SOLDER SIDE)



NOTE :

1. DO NOT MOUNT THE FOLLOWING COMPONENTS –
   RESISTORS – R5, R10 & R11

9.13. COMPONENT LIST FOR ROI CARD

9.13.1. ICs

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	U1,U6	A	EUI-C0001228-A10	+5V DUAL RS-232 TRANSCEIVER SOICW	2
2.	U2	A	EUL-S0MAX253-AE0	TFMR DRVR FOR ISO RS485 I/F µSOIC 8PIN	1
3.	U3	A	EUD-Z0007404-A00	HEX INVERTER SOICS	1
4.	U4,U5	A	EUO-X0004N35-000	OPTO ISOLATOR PDIP3	2

9.13.2. Resistors

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	R1,R12	A	ERF-E000.000-4J0	ZERO-OHM JUMPER SIZE 0805 CHIP RESISTOR	2
2.	R2,R6	A	ERF-E330.000-410	330OHMS, 125mW, 5%, 0805 SIZE, SM CHIP RESISTOR	2
3.	R3	A	ERF-E110.000-410	110OHMS, 125mW, 5% 0805 SIZE, SM CHIP RESISTOR	1
4.	R4,R9	A	ERF-K003.300-410	3.3 KOHMS, 125mW, 5% 0805 SIZE, SM CHIP RESISTOR	2
5.	R5,R10,R11	A	-	NOT USED	
6.	R7,R8	A	ERF-E390.000-410	390OHMS, 125mW, 5% 0805 SIZE, SM CHIP RESISTOR	2

9.13.3. Capacitors

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	C1		ECE-M00022.0-R16	22µF 16V ±20% RAD ALU ELEC CAP	1
2.	C2,C3		ECT-MC0010.0-C22	10□F 20V ±10% 6032 TANT CHIP CAP	2
3.	C4-C8,C11,C13-C16		ECT-MB0004.7-C13	4.7□F ±10% 16V 3528 TANT CHIP CAP	10
4.	C9,C10,C12		ECC-K00100.0-C20	0.1□F 25V –20% to 80% CER CHIP 0805 (Z5U)	3

9.13.4. Transformers

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	T1	A	ETF-TFMR0098-100	1CT: 1.75CT TRANSFORMER FOR ISOLATED RS-485 I/F	1

9.13.5. Diodes

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	CR1,CR4	A	EDC-001N5711-060	60V 15MA SCHOTTKY DIODE (DO-35)	2
2.	CR2,CR3	A	EDC-001N5817-170	20V 1A SCHOTTKY DIODE (CASE (59-04)	2

9.13.6. Voltage Regulator

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	VR1	A	EUL-X0LM1117-S20	REGULATOR LDO 800MA TO-252	1

9.13.7. Mechanical

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	J1	C	MCC-SPMRST04-002	CONN S/R MALE 4P R/A	1
2.	J2	C	MCC-DCFRST25-001	CONN D TYPE FEMALE R/A 25P (NO SCREWS AND COVER)	1
3.		A	MCC-CSSSZ032-401	SCR CSK SST M3x8	2

9.13.8. Miscellaneous

Sl. No.	Component Ref. Code	CGY	C-DOT Part Code	Description	Qty
1.	DS1	A	EVV-LEDGREEN-010	ROUND (3MM) GREEN LED	1
a.		A	MPR-OIUNZ040-401	LED SPACER (ROI ADAPTOR)	1
2.		A	MAR-OIUNZ000-301	ROI ADAPTER ASSY	1
3.	BARE PCB	A	EPC-ROIG03/T-S00	RS232 OPTO ISOLATOR CARD PCB	1